The Causal Effects of Education in UK Biobank

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Guide to Supplementary materials

Supplementary Table 1 contains a description of the cohort.

Supplementary Table 2 reports the plots of baseline differences across the reform using Jackson and Swanson bias component plots.

Supplementary Tables 3 and **4** report the gender stratified results using a 12 month bandwidth without allowing for secular time trends.

Supplementary Table 5 reports estimated heterogeneity in the effect of the reform by whether the individual was predicted to stay in school past the age of 16. This prediction was based on gender, maternal smoking during pregnancy, birthweight, comparative height and weight at age 8, breastfed, number of brothers and sisters, the educational attainment allele score as defined in the methods, ethnic minority, and indicators for assessment centre.

Supplementary Table 6, **7** and **8** report the analysis repeated using a Calonico, Cattaneo, and Titiunik optimal bandwidths for all, males and females respectively.

Supplementary Tables 9, **10**, and **11** report the unweighted analysis using a 12 month bandwidth for all, males and females respectively.

Supplementary Tables 12, **13**, and **14** report the instrumental variable estimates using a 12 month bandwidth for all, males, and females respectively.

Supplementary Figure 1 reports a flow chart of participants into the study.

Supplementary Figure 2 reports the effect of the reform on males and females. The red lines are quadratic trends estimated either side of the reform.

Supplementary Figure 3 and **4** reports the effects of the education using instrumental variables estimators and a 12 month bandwidth.

We were concerned that the results using a 12 month bandwidth may have been affected by year-on-year differences in each outcome. We investigated this by repeating the analysis on consecutive two year samples selected from the school years before and after the reform. We estimated the year-on-year differences in independent two year samples for each outcome for the 10 years before and after the reform. The forest plots below show these differences. Each estimate uses a similar specification (covariates, weighting, and clustered standard errors) as the analysis presented in **Table 1**. If the year-on-year difference in an outcome either side of the reform was larger than the average year-on-year differences observed before and after the reform, then it is likely to be an effect of the reform. The final statistic reported in each figure is the difference between the estimated difference across the ROSLA cohort versus the pooled (average) year-on-year difference for all other years. This statistic was calculated from the summary statistics and Bland-Altman tests. **Supplementary Figures 5** to **30** report the results for each of the 25 outcomes described in the main manuscript.

For example, participants in the first year affected by the reform had lower BMI than those in the previous year (**Supplementary Figure 21**). These differences were greater than the year-on-year differences seen both before and after the reform. This suggests that increasing the school leaving to 16 led to the participants having lower BMI later in life. Whereas for other

outcomes, such as experiencing a heart attack, whilst participants in the first year affected by the reform were less likely to report having been diagnosed with a heart attack (**Supplementary Figure 8**), these differences were similar to year-on-year differences observed before and after the reform. This suggests that the reform had little detectable effect on risk of having a heart attack.

Supplementary Figures 30 and **31** report the overall summary statistics for each outcome without using inverse probability weights. The methods for these plots are otherwise identical to the main (weighted) results reported in **Figure 2**. Finally, **Supplementary Figure 32** plots the probability of being sampled in UK Biobank by age on 30th June 2009. We find little evidence that people affected by the reform were more likely to participate in UK Biobank.

Supplementary Table 1: Cohort of UK Biobank participants born between September 1956 and August 1958

	N	Count	Proportion (%)
Male	22,138	9,699	43.8
Mother smoked during pregnancy	19,442	6,519	33.5
Breastfed	18,226	12,695	69.7
Father alive	21,618	8,198	37.9
Mother alive	21,822	13,388	61.4
Hypertension	21,768	3,978	18.3
Diabetes	22,049	661	3.0
Stroke	22,110	184	0.8
Heart attack	22,110	183	0.8
Cancer	22,011	1,813	8.2
Died	22,138	191	0.9
Ever smoked	22,086	8,899	40.3
Currently smoke	22,086	2,602	11.8
Income over £18k	19,921	17,398	87.3
Income over £31k	19,921	13,532	67.9
Income over £52k	19,921	7,524	37.8
Income over £100k	19,921	1,638	8.2

	N	Mean	Standard deviation	Minimum	Maximum
Birthweight (kg)	14,860	3.32	0.63	0.57	7.26
Number of brothers	21,848	1.15	1.18	0.00	12.00
Number of sisters	21,851	1.06	1.13	0.00	14.00
Genome-wide allele education score	7,005	-0.01	0.97	-4.37	3.48
Grip strength (kg)	21,989	1.49	10.85	-30.66	46.46
Arterial Stiffness	8,537	-0.32	3.04	-8.34	83.63
Height (cm)	22,077	169.42	9.16	122.0	206.0
BMI (kg/m^2)	22,055	27.32	4.96	14.53	61.54
Diastolic blood pressure (mmHg)	21,494	82.55	10.29	45.0	131.5
Systolic blood pressure (mmHg)	21,492	133.50	16.82	84.0	268.0
Intelligence (0 to 13)	8,540	6.34	2.10	0.00	13.00
Happiness (0 to 5 Likert)	8,626	3.36	0.72	0.00	5.00
Alcohol consumption (1 low, 5 high)	22,123	3.14	1.42	0.00	5.00
Hours of television viewing per day*	21,206	2.63	1.59	0.00	24.00
Moderate exercise (days/week)	21,330	3.46	2.34	0.00	7.00
Vigorous exercise (days/week)	21,379	1.91	1.95	0.00	7.00

Supplementary Table 2: Baseline differences between UK Biobank participants who left before and after age 15 (left) and differences between those who left school before and after the reform (right).

Independent variable:		**Remained in school after age 15**				**ROSLA cohort vs. pre-ROSLA cohort**			
		Risk	95% Confidence interval		P-	Risk	95% Confidence interval		P-
Dependent variable:	N	difference	Lower	Upper	value	difference	Lower	Upper	value
Male	22,138	-0.003	-0.024	0.019	0.79	0.000	-0.016	0.016	0.98
Mother smoked during pregnancy	19,442	-0.161	-0.185	-0.137	1.5E-8	-0.010	-0.024	0.003	0.13
Breastfed	18,226	0.095	0.074	0.117	9.9E-7	-0.014	-0.028	0.001	0.07
Father alive	21,618	0.104	0.084	0.123	1.6E-7	0.043	0.025	0.061	2.9E-4
Mother alive	21,822	0.110	0.089	0.130	1.3E-7	0.037	0.026	0.048	1.2E-5
		Mean				Mean			
		difference				difference			
Birthweight (kg)	14,860	0.033	0.000	0.066	0.05	0.007	-0.019	0.033	0.56
Number of brothers	21,848	-0.507	-0.596	-0.419	6.9E-8	-0.031	-0.077	0.016	0.17
Number of sisters	21,851	-0.405	-0.518	-0.292	7.4E-6	0.010	-0.031	0.051	0.61
Genome-wide education allele Z-score	7,005	0.015	0.011	0.019	3.0E-6	0.001	-0.001	0.002	0.22

Notes: ROSLA= Raising of the school leaving age. The results in the left hand columns present the association of staying on school after age 15 and the covariates in the two cohorts directly before and after the reform. The right columns present the differences in these covariates between participants who were born before immediately before and after the reform. Robust standard errors clustered by year and month of birth reported.

Supplementary Table 3: The associations between remaining in school after age 15, and attending school after the raising of the school leaving age (ROSLA) and outcomes for MALES.

Date of birth:	Left school after age 15 Sept 1955-August 1956 to Sept 1956-August 1957					Affected by ROSLA Sept 1956-August 1957 to Sept 1957-August 1958			
	N	Mean/risk difference	95% Confidence interval Lower	Upper	P-value	Mean/risk difference	95% Confidence interval Lower	Upper	P-value
Hypertension	9,554	-0.043	-0.073	-0.014	0.005	-0.021	-0.028	-0.015	1.7E-6
Diabetes	9,650	-0.035	-0.055	-0.015	0.001	-0.011	-0.016	-0.007	1.5E-5
Stroke	9,684	-0.005	-0.013	0.002	0.16	-0.002	-0.004	0.001	0.23
Heart attack	9,684	-0.018	-0.029	-0.008	0.001	-0.002	-0.004	0.000	0.02
Depression	9,376	0.022	-0.002	0.045	0.07	-0.005	-0.019	0.009	0.45
Cancer	9,681	-0.006	-0.017	0.006	0.31	-0.006	-0.011	0.000	0.04
Died	9,699	-0.014	-0.023	-0.004	0.007	-0.007	-0.011	-0.003	6.7E-4
Ever smoked	9,681	-0.222	-0.246	-0.198	1.4E-15	-0.027	-0.047	-0.006	0.01
Currently smoke	9,681	-0.170	-0.195	-0.146	5.2E-13	-0.011	-0.019	-0.003	0.007
Income over £18k	8,904	0.146	0.117	0.175	2.9E-10	0.026	0.017	0.034	3.0E-6
Income over £31k	8,904	0.302	0.263	0.341	6.1E-14	0.062	0.053	0.072	1.3E-12
Income over £52k	8,904	0.276	0.243	0.310	1.7E-14	0.036	0.020	0.052	9.9E-5
Income over £100k	8,904	0.090	0.079	0.100	6.4E-15	0.009	0.003	0.015	0.006
Grip strength (kg)*	9,618	0.852	0.196	1.508	0.01	0.613	0.418	0.809	1.3E-6
Arterial Stiffness*	3,674	-1.029	-1.359	-0.700	1.3E-6	-0.202	-0.350	-0.053	0.01
Height (cm)*	9,666	1.793	1.414	2.172	1.2E-9	0.395	0.196	0.594	4.3E-4
BMI (kg/m^2)*	9,656	-0.985	-1.325	-0.644	4.2E-6	-0.205	-0.361	-0.049	0.01
Diastolic blood pressure (mmHg)*	9,405	-0.673	-1.653	0.307	0.17	-0.242	-0.586	0.101	0.16
Systolic blood pressure (mmHg)*	9,404	-0.868	-2.238	0.502	0.20	-0.588	-1.038	-0.139	0.01
Intelligence (0 to 13)*	3,644	1.794	1.446	2.143	2.3E-10	0.154	0.048	0.261	0.006
Happiness (0 to 5 Likert)*	3,687	-0.026	-0.131	0.078	0.61	-0.028	-0.064	0.008	0.12
Alcohol consumption (1 low, 5 high)*	9,692	0.295	0.180	0.410	2.1E-5	0.056	0.023	0.089	0.002
Hours of television viewing per day*	9,334	-0.883	-0.983	-0.782	3.6E-15	-0.165	-0.204	-0.126	9.3E-9
Moderate exercise (days/week)*	9,421	-0.675	-0.877	-0.473	4.8E-7	0.023	-0.033	0.079	0.40
Vigorous exercise (days/week)*	9,395	-0.279	-0.416	-0.142	3.3E-4	0.010	-0.039	0.059	0.68

Notes: * denotes mean differences. Estimated using robust linear regression, with standard errors clustered by year and month of birth. All estimates adjust for month of birth and sex. Inverse probability weights used to correct for under-sampling of participants who left school at age 15 (weight=1.8857).

Supplementary Table 4: The associations between remaining in school after age 15, and attending school after the raising of the school leaving age (ROSLA) and outcomes <u>for FEMALES</u>.

Date of birth:	Left school after age 15 Sept 1955-August 1956 to Sept 1956-August 1957					Affected by ROSLA Sept 1956-August 1957 to Sept 1957-August 1958			
	N	Mean/risk difference	95% Confidence interval Lower	Upper	P-value	Mean/risk difference	95% Confidence interval Lower	Upper	P-value
Hypertension	12,214	-0.035	-0.055	-0.016	0.001	-0.015	-0.029	-0.001	0.03
Diabetes	12,399	-0.007	-0.015	0.001	0.07	-0.006	-0.009	-0.003	2.9E-4
Stroke	12,426	-0.007	-0.012	-0.002	0.01	-0.004	-0.005	-0.003	7.0E-6
Heart attack	12,426	-0.005	-0.009	-0.001	0.03	-0.003	-0.004	-0.002	2.7E-5
Depression	11,709	0.038	0.023	0.054	3.8E-5	-0.001	-0.012	0.011	0.86
Cancer	12,330	-0.006	-0.025	0.012	0.49	-0.005	-0.013	0.003	0.23
Died	12,439	-0.004	-0.008	0.001	0.12	-0.003	-0.006	0.000	0.07
Ever smoked	12,405	-0.192	-0.226	-0.158	4.4E-11	-0.019	-0.030	-0.009	6.6E-4
Currently smoke	12,405	-0.117	-0.134	-0.099	1.5E-12	-0.006	-0.013	0.001	0.11
Income over £18k	11,017	0.196	0.165	0.228	4.3E-12	0.023	0.016	0.030	1.1E-6
Income over £31k	11,017	0.291	0.256	0.325	8.5E-15	0.045	0.038	0.051	3.4E-13
Income over £52k	11,017	0.240	0.222	0.258	2.8E-19	0.029	0.017	0.042	7.1E-5
Income over £100k	11,017	0.070	0.060	0.080	8.2E-13	0.003	-0.007	0.013	0.55
Grip strength (kg)*	12,371	1.503	1.174	1.832	2.2E-9	0.506	0.351	0.662	7.1E-7
Arterial Stiffness*	4,863	-0.553	-0.761	-0.346	1.3E-5	-0.058	-0.189	0.073	0.37
Height (cm)*	12,411	1.753	1.402	2.105	4.2E-10	0.204	0.094	0.315	8.5E-4
BMI (kg/m^2)*	12,399	-1.425	-1.755	-1.094	6.3E-9	-0.287	-0.448	-0.126	0.001
Diastolic blood pressure (mmHg)*	12,089	-1.051	-1.532	-0.569	1.6E-4	0.060	-0.285	0.404	0.72
Systolic blood pressure (mmHg)*	12,088	-2.345	-3.245	-1.445	1.8E-5	-0.632	-1.142	-0.122	0.02
Intelligence (0 to 13)*	4,896	1.549	1.357	1.741	2.4E-14	0.141	0.065	0.216	7.9E-4
Happiness (0 to 5 Likert)*	4,939	0.032	-0.032	0.097	0.31	-0.005	-0.031	0.021	0.68
Alcohol consumption (1 low, 5 high)*	12,431	0.330	0.244	0.416	5.2E-8	0.021	-0.031	0.073	0.42
Hours of television viewing per day*	11,872	-0.796	-0.910	-0.682	5.0E-13	-0.116	-0.164	-0.069	4.2E-5
Moderate exercise (days/week)*	11,909	-0.320	-0.489	-0.152	6.8E-4	-0.010	-0.092	0.071	0.79
Vigorous exercise (days/week)*	11,984	-0.008	-0.131	0.114	0.89	0.007	-0.035	0.050	0.72

Notes: * denotes mean differences. Estimated using robust linear regression, with standard errors clustered by year and month of birth. All estimates adjust for month of birth and sex. Inverse probability weights used to correct for under-sampling of participants who left school at age 15 (weight=1.8857).

Supplementary Table 5: Heterogeneity in the effect of reform on outcomes by likelihood of remaining in school. The effect of the reform on those who were predicted to leave at age 15 is indicated in the "leave" rows. The effect on those who were predicted to leave is the sum of the coefficients.

	Predicted to	N	Mean difference	95% Confidence interval Lower	Upper	P-value
Hypertension	Leave	21768	0.018	-0.029	0.065	0.44
	Stay		-0.046	-0.111	0.019	0.15
Diabetes	Leave	22049	-0.024	-0.061	0.013	0.19
	Stay		0.022	-0.023	0.067	0.33
Stroke	Leave	22110	0.009	-0.009	0.027	0.31
	Stay		-0.016	-0.039	0.007	0.16
Heart attack	Leave	22110	-0.009	-0.029	0.011	0.35
	Stay		0.009	-0.015	0.033	0.45
Depression	Leave	21085	-0.004	-0.056	0.049	0.89
	Stay		0.000	-0.075	0.075	1.00
Cancer	Leave	22011	-0.009	-0.050	0.033	0.67
	Stay		0.005	-0.051	0.060	0.87
Died	Leave	22138	0.000	-0.019	0.020	0.97
	Stay		-0.006	-0.031	0.018	0.59
Ever smoked	Leave	22086	0.012	-0.076	0.101	0.78
	Stay		-0.042	-0.157	0.073	0.45
Currently smoke	Leave	22086	-0.049	-0.104	0.006	0.08
	Stay		0.058	-0.004	0.121	0.07
Income over £18k	Leave	19921	0.077	0.007	0.146	0.03
	Stay		-0.078	-0.163	0.007	0.07
Income over £31k	Leave	19921	0.095	0.028	0.163	0.008
	Stay		-0.070	-0.158	0.019	0.12
Income over £52k	Leave	19921	0.069	0.017	0.120	0.01
	Stay		-0.062	-0.145	0.021	0.13
Income over £100k	Leave	19921	-0.019	-0.046	0.008	0.16
	Stay		0.028	-0.015	0.071	0.20
Grip strength (kg)*	Leave	21989	1.267	0.128	2.407	0.03
	Stay		-1.032	-2.654	0.589	0.20
Arterial Stiffness*	Leave	8537	0.073	-0.924	1.069	0.88
	Stay		-0.217	-1.600	1.167	0.74
Height (cm)*	Leave	22077	-0.527	-1.468	0.415	0.26
	Stay		0.892	-0.298	2.082	0.13
BMI (kg/m^2)*	Leave	22055	-0.666	-1.403	0.071	0.07
	Stay		0.612	-0.252	1.475	0.16
Diastolic blood pressure (mmHg)*	Leave	21494	0.024	-1.909	1.957	0.98
	Stay		-0.052	-2.474	2.369	0.96
Systolic blood pressure (mmHg)*	Leave	21492	-0.949	-3.462	1.564	0.44
	Stay		0.581	-2.840	4.001	0.73
Intelligence (0 to 13)*	Leave	8540	0.062	-0.403	0.527	0.78
	Stay		0.051	-0.628	0.730	0.87
Happiness (0 to 5 Likert)*	Leave	8626	0.108	-0.039	0.256	0.14
	Stay		-0.164	-0.313	-0.016	0.03

	Predicted to	N	Mean difference	95% Confidence interval Lower	Upper	P-value
Alcohol consumption (1 low, 5 high)*	Leave	22123	0.207	-0.018	0.433	0.07
	Stay		-0.243	-0.544	0.059	0.11
Hours of television viewing per day*	Leave	21206	0.000	-0.215	0.215	1.00
	Stay		-0.148	-0.452	0.155	0.32
Moderate exercise (days/week)*	Leave	21330	0.042	-0.297	0.382	0.80
	Stay		-0.033	-0.464	0.399	0.88
Vigorous exercise (days/week)*	Leave	21379	0.075	-0.169	0.320	0.53
	Stay		-0.083	-0.400	0.233	0.59

Notes: * denotes mean differences. The main effect is the effect in those who had a predicted probability of staying of 0%. The largest possible prediction is 1, those who were highly likely to remain in school (the always takers). The effect on always takers is the sum of the two coefficients for any outcome. The effect on compliers who had zero probability of remaining in school is indicated by the "leave" coefficients. Inverse probability weights used to correct for under-sampling of participants who left school at age 15 (weight=1.8857).

Supplementary Table 6: The effects of remaining in school after age 15 conventional regression (left) and effect of the reform using Calonico, Cattaneo, and Titiunik optimal bandwidths (right), MALES and FEMALES.

	CCT Optimal Bandwidth	Left school after age 15					Affected by ROSLA			
		N	Mean/risk difference	95% Confidence interval Lower	Upper	P-value	Mean/risk difference	95% Confidence interval Lower	Upper	P-value
Hypertension	65.4	119,605	-0.046	-0.054	-0.039	1.2E-23	-0.006	-0.022	0.011	0.50
Diabetes	48.9	88,903	-0.017	-0.021	-0.012	8.0E-10	-0.011	-0.017	-0.005	4.5E-4
Stroke	57.9	106,449	-0.007	-0.009	-0.005	2.9E-8	-0.004	-0.009	0.001	0.15
Heart attack	42.8	78,285	-0.014	-0.017	-0.010	3.8E-11	-0.002	-0.006	0.001	0.25
Depression	24.0	41,217	0.033	0.020	0.046	4.0E-6	-0.035	-0.047	-0.024	9.4E-8
Cancer	52.5	96,344	-0.007	-0.013	0.000	0.04	0.003	-0.007	0.014	0.53
Died	31.7	58,046	-0.004	-0.007	-0.001	0.004	-0.005	-0.009	-0.002	0.001
Ever smoked	54.3	100,710	-0.178	-0.190	-0.165	<6.0E-39	-0.041	-0.060	-0.022	3.1E-5
Currently smoke	62.3	115,497	-0.120	-0.129	-0.111	<6.0E-39	-0.017	-0.031	-0.003	0.02
Income over £18k	43.1	72,150	0.186	0.176	0.197	<6.0E-39	0.035	0.017	0.053	1.6E-4
Income over £31k	38.7	63,539	0.289	0.276	0.303	<6.0E-39	0.057	0.044	0.070	2.4E-13
Income over £52k	47.3	78,628	0.267	0.257	0.276	<6.0E-39	0.042	0.012	0.071	0.007
Income over £100k	53.7	88,762	0.076	0.072	0.080	<6.0E-39	-0.005	-0.019	0.008	0.45
Grip strength (kg)*	40.4	73,933	1.198	1.016	1.380	1.4E-21	0.055	-0.242	0.351	0.72
Arterial Stiffness*	34.5	24,209	-0.553	-0.744	-0.362	2.1E-7	-0.272	-0.478	-0.066	0.01
Height (cm)*	35.4	65,001	1.943	1.800	2.086	7.2E-39	0.171	-0.199	0.542	0.36
BMI (kg/m^2)*	45.8	83,574	-1.324	-1.451	-1.198	4.2E-36	-0.297	-0.462	-0.131	6.0E-4
Diastolic blood pressure (mmHg)*	47.8	84,855	-0.652	-0.865	-0.439	2.5E-8	-0.127	-0.836	0.581	0.72
Systolic blood pressure (mmHg)*	50.0	88,400	-1.356	-1.690	-1.022	2.0E-12	-0.076	-0.989	0.837	0.87
Intelligence (0 to 13)*	41.6	29,246	1.848	1.758	1.939	<6.0E-39	0.126	-0.010	0.262	0.07
Happiness (0 to 5 Likert)*	36.8	25,851	0.006	-0.028	0.040	0.73	0.026	-0.005	0.056	0.09
Alcohol consumption (1 low, 5 high)*	52.2	96,866	0.420	0.387	0.454	<6.0E-39	0.048	-0.004	0.101	0.07
Hours of television viewing per day*	32.7	57,394	-0.873	-0.931	-0.816	<6.0E-39	-0.067	-0.184	0.050	0.26
Moderate exercise (days/week)*	40.8	71,838	-0.517	-0.593	-0.442	1.5E-22	0.027	-0.106	0.160	0.69
Vigorous exercise (days/week)*	51.9	91,824	-0.223	-0.270	-0.176	1.5E-15	0.004	-0.081	0.088	0.93

Notes: CCT = Calonico, Cattaneo, and Titiunik. * denotes mean differences. Estimated using robust linear regression, with standard errors clustered by year and month of birth. All estimates adjust for month of birth, sex, and linear time-trends for before and after reform. Inverse probability weights used to correct for under-sampling of participants who left school at age 15 (weight=1.8857).

Supplementary Table 7: The effects of remaining in school after age 15 conventional regression (left) and effect of the reform using Calonico, Cattaneo, and Titiunik optimal bandwidths (right), MALES.

	CCT Optimal Bandwidth	Left school after age 15					Affected by ROSLA			
		N	Mean/risk difference	95% Confidence interval Lower	Upper	P-value	Mean/risk difference	95% Confidence interval Lower	Upper	P-value
Hypertension	65.4	52,695	-0.055	-0.069	-0.041	8.6E-13	-0.007	-0.033	0.019	0.60
Diabetes	48.9	38,965	-0.023	-0.032	-0.014	1.3E-6	-0.014	-0.031	0.004	0.12
Stroke	57.9	46,790	-0.006	-0.009	-0.002	0.004	-0.005	-0.012	0.002	0.13
Heart attack	42.8	34,282	-0.025	-0.032	-0.017	4.3E-9	-0.012	-0.019	-0.004	0.004
Depression	24.0	18,217	0.030	0.014	0.046	4.7E-4	-0.021	-0.038	-0.003	0.02
Cancer	52.5	42,448	-0.002	-0.010	0.006	0.64	-0.005	-0.022	0.012	0.53
Died	31.7	25,423	-0.008	-0.014	-0.002	0.008	0.004	-0.008	0.015	0.55
Ever smoked	54.3	44,227	-0.188	-0.204	-0.171	<6.0E-39	-0.025	-0.068	0.018	0.25
Currently smoke	62.3	50,728	-0.128	-0.141	-0.114	7.5E-37	-0.020	-0.038	-0.002	0.03
Income over £18k	43.1	32,308	0.163	0.146	0.181	7.5E-32	0.030	0.001	0.059	0.04
Income over £31k	38.7	28,398	0.286	0.264	0.309	2.2E-38	0.028	-0.003	0.059	0.07
Income over £52k	47.3	35,254	0.292	0.275	0.309	<6.0E-39	0.057	0.023	0.092	0.001
Income over £100k	53.7	39,832	0.088	0.082	0.095	<6.0E-39	0.025	0.009	0.041	0.002
Grip strength (kg)*	40.4	32,352	0.836	0.490	1.182	7.1E-6	-0.247	-1.102	0.608	0.57
Arterial Stiffness*	34.5	10,478	-0.710	-1.011	-0.410	1.3E-5	-0.374	-0.733	-0.015	0.04
Height (cm)*	35.4	28,413	1.986	1.753	2.220	1.6E-26	0.174	-0.142	0.489	0.28
BMI (kg/m^2)*	45.8	36,651	-1.191	-1.362	-1.019	5.9E-24	-0.322	-0.826	0.181	0.21
Diastolic blood pressure (mmHg)*	47.8	37,264	-0.777	-1.192	-0.361	3.5E-4	0.100	-0.557	0.757	0.76
Systolic blood pressure (mmHg)*	50.0	38,814	-1.600	-2.293	-0.907	1.4E-5	0.538	-0.300	1.376	0.21
Intelligence (0 to 13)*	41.6	12,604	1.951	1.797	2.105	<6.0E-39	0.195	-0.101	0.492	0.19
Happiness (0 to 5 Likert)*	36.8	11,125	-0.006	-0.063	0.051	0.83	0.030	-0.056	0.116	0.49
Alcohol consumption (1 low, 5 high)*	52.2	42,519	0.369	0.314	0.424	3.6E-24	0.115	0.030	0.200	0.009
Hours of television viewing per day*	32.7	25,204	-0.955	-1.040	-0.870	4.6E-32	-0.248	-0.451	-0.045	0.02
Moderate exercise (days/week)*	40.8	31,730	-0.787	-0.904	-0.670	4.2E-22	-0.155	-0.441	0.131	0.28
Vigorous exercise (days/week)*	51.9	40,470	-0.415	-0.499	-0.331	1.9E-16	-0.025	-0.173	0.122	0.73

Notes: CCT = Calonico, Cattaneo, and Titiunik. * denotes mean differences. Estimated using robust linear regression, with standard errors clustered by year and month of birth. All estimates adjust for month of birth, sex, and linear time-trends for before and after reform. Inverse probability weights used to correct for under-sampling of participants who left school at age 15 (weight=1.8857).

Supplementary Table 8: The effects of remaining in school after age 15 conventional regression (left) and effect of the reform using Calonico, Cattaneo, and Titiunik optimal bandwidths (right), FEMALES.

	CCT Optimal Bandwidth	Left school after age 15					Affected by ROSLA			
		N	Mean/risk difference	95% Confidence interval Lower	Upper	P-value	Mean/risk difference	95% Confidence interval Lower	Upper	P-value
Hypertension	65.4	66,910	-0.040	-0.048	-0.032	8.0E-17	-0.003	-0.020	0.014	0.73
Diabetes	48.9	49,938	-0.012	-0.017	-0.007	2.1E-5	-0.008	-0.016	0.000	0.04
Stroke	57.9	59,659	-0.008	-0.010	-0.005	3.2E-7	-0.001	-0.005	0.003	0.67
Heart attack	42.8	44,003	-0.006	-0.008	-0.003	5.8E-5	-0.006	-0.009	-0.004	5.0E-6
Depression	24.0	23,000	0.035	0.019	0.051	5.7E-5	-0.047	-0.061	-0.034	4.9E-9
Cancer	52.5	53,896	-0.011	-0.021	-0.001	0.04	0.020	0.002	0.038	0.03
Died	31.7	32,623	-0.001	-0.004	0.001	0.29	-0.002	-0.006	0.002	0.33
Ever smoked	54.3	56,483	-0.170	-0.186	-0.154	<6.0E-39	-0.029	-0.051	-0.007	0.009
Currently smoke	62.3	64,769	-0.114	-0.124	-0.104	<6.0E-39	-0.015	-0.034	0.004	0.13
Income over £18k	43.1	39,842	0.205	0.191	0.219	<6.0E-39	0.031	0.013	0.049	7.4E-4
Income over £31k	38.7	35,141	0.291	0.270	0.312	<6.0E-39	0.048	0.025	0.071	7.3E-5
Income over £52k	47.3	43,374	0.247	0.235	0.258	<6.0E-39	0.022	-0.012	0.057	0.20
Income over £100k	53.7	48,930	0.066	0.061	0.071	<6.0E-39	0.016	-0.001	0.032	0.06
Grip strength (kg)*	40.4	41,581	1.472	1.304	1.640	5.7E-29	-0.168	-0.578	0.242	0.42
Arterial Stiffness*	34.5	13,731	-0.432	-0.617	-0.246	1.6E-5	-0.278	-0.478	-0.079	0.007
Height (cm)*	35.4	36,588	1.908	1.714	2.103	4.2E-30	-0.204	-0.473	0.065	0.13
BMI (kg/m^2)*	45.8	46,923	-1.426	-1.614	-1.237	2.8E-26	0.239	-0.196	0.674	0.28
Diastolic blood pressure (mmHg)*	47.8	47,591	-0.555	-0.833	-0.276	1.5E-4	-0.104	-0.979	0.771	0.81
Systolic blood pressure (mmHg)*	50.0	49,586	-1.165	-1.606	-0.724	9.3E-7	0.849	0.044	1.654	0.04
Intelligence (0 to 13)*	41.6	16,642	1.773	1.674	1.873	<6.0E-39	0.174	-0.058	0.406	0.14
Happiness (0 to 5 Likert)*	36.8	14,726	0.014	-0.027	0.055	0.50	0.048	-0.014	0.109	0.13
Alcohol consumption (1 low, 5 high)*	52.2	54,347	0.459	0.418	0.500	<6.0E-39	0.078	0.017	0.139	0.01
Hours of television viewing per day*	32.7	32,190	-0.810	-0.882	-0.737	6.0E-32	-0.045	-0.233	0.143	0.64
Moderate exercise (days/week)*	40.8	40,108	-0.305	-0.386	-0.223	1.1E-10	0.009	-0.252	0.270	0.95
Vigorous exercise (days/week)*	51.9	51,354	-0.072	-0.131	-0.012	0.02	0.068	-0.090	0.226	0.39

Notes: CCT = Calonico, Cattaneo, and Titiunik. * denotes mean differences. Estimated using robust linear regression, with standard errors clustered by year and month of birth. All estimates adjust for month of birth, sex, and linear time-trends for before and after reform. Inverse probability weights used to correct for under-sampling of participants who left school at age 15 (weight=1.8857).

Supplementary Table 9: The associations between remaining in school after age 15, and attending school after the raising of the school leaving age (ROSLA) and outcomes for MALES and FEMALES, UNWEIGHTED.

Date of birth:	Left school after age 15 Sept 1955-August 1956 to Sept 1956-August 1957					Affected by ROSLA Sept 1956-August 1957 to Sept 1957-August 1958			
	N	Mean/risk difference	95% Confidence interval Lower	Upper	P-value	Mean/risk difference	95% Confidence interval Lower	Upper	P-value
Hypertension	21,768	-0.039	-0.057	-0.020	2.5E-4	-0.013	-0.021	-0.005	0.003
Diabetes	22,049	-0.019	-0.031	-0.008	0.002	-0.007	-0.009	-0.004	4.6E-5
Stroke	22,110	-0.006	-0.011	-0.002	0.01	-0.003	-0.004	-0.001	0.007
Heart attack	22,110	-0.011	-0.017	-0.005	0.001	-0.002	-0.003	-0.001	0.005
Depression	21,085	0.031	0.017	0.045	1.1E-4	-0.005	-0.013	0.002	0.15
Cancer	22,011	-0.006	-0.020	0.008	0.39	-0.004	-0.010	0.002	0.20
Died	22,138	-0.008	-0.013	-0.003	0.005	-0.004	-0.007	-0.002	0.002
Ever smoked	22,086	-0.206	-0.228	-0.183	2.3E-15	-0.007	-0.017	0.003	0.18
Currently smoke	22,086	-0.141	-0.155	-0.127	1.9E-16	0.003	-0.002	0.008	0.30
Income over £18k	19,921	0.174	0.153	0.195	1.2E-14	0.008	0.002	0.013	0.01
Income over £31k	19,921	0.295	0.273	0.318	7.1E-19	0.025	0.020	0.031	2.4E-9
Income over £52k	19,921	0.256	0.239	0.274	4.7E-20	0.009	-0.003	0.020	0.14
Income over £100k	19,921	0.079	0.071	0.087	4.3E-16	-0.002	-0.008	0.005	0.56
Grip strength (kg)*	21,989	1.213	0.943	1.482	2.9E-9	0.414	0.339	0.488	5.3E-11
Arterial Stiffness*	8,537	-0.747	-0.929	-0.564	1.6E-8	-0.043	-0.149	0.064	0.42
Height (cm)*	22,077	1.766	1.516	2.016	4.0E-13	0.076	-0.020	0.172	0.11
BMI (kg/m^2)*	22,055	-1.232	-1.478	-0.986	3.8E-10	-0.119	-0.195	-0.042	0.004
Diastolic blood pressure (mmHg)*	21,494	-0.877	-1.379	-0.376	0.001	0.036	-0.176	0.247	0.73
Systolic blood pressure (mmHg)*	21,492	-1.684	-2.445	-0.923	1.3E-4	-0.427	-0.704	-0.150	0.004
Intelligence (0 to 13)*	8,540	1.648	1.448	1.848	1.5E-14	-0.010	-0.067	0.046	0.71
Happiness (0 to 5 Likert)*	8,626	0.007	-0.048	0.062	0.79	-0.018	-0.040	0.004	0.10
Alcohol consumption (1 low, 5 high)*	22,123	0.314	0.224	0.404	2.3E-7	0.001	-0.022	0.024	0.95
Hours of television viewing per day*	21,206	-0.833	-0.916	-0.749	2.7E-16	-0.054	-0.088	-0.021	0.002
Moderate exercise (days/week)*	21,330	-0.476	-0.643	-0.309	5.1E-6	0.045	0.007	0.083	0.02
Vigorous exercise (days/week)*	21,379	-0.127	-0.207	-0.047	0.003	0.026	-0.005	0.056	0.10

Notes: * denotes mean differences. Estimated using robust linear regression, with standard errors clustered by year and month of birth. All estimates adjust for month of birth and sex. No weighting

Supplementary Table 10: The associations between remaining in school after age 15, and attending school after the raising of the school leaving age (ROSLA) and outcomes for MALES, UNWEIGHTED.

Date of birth:	Left school after age 15 Sept 1955-August 1956 to Sept 1956-August 1957					Affected by ROSLA Sept 1956-August 1957 to Sept 1957-August 1958			
	N	Mean/risk difference	95% Confidence interval Lower	Upper	P-value	Mean/risk difference	95% Confidence interval Lower	Upper	P-value
Hypertension	9,554	-0.043	-0.073	-0.014	0.006	-0.015	-0.022	-0.007	<0.001
Diabetes	9,650	-0.035	-0.056	-0.014	0.002	-0.009	-0.013	-0.004	<0.001
Stroke	9,684	-0.005	-0.013	0.002	0.17	-0.001	-0.004	0.001	0.32
Heart attack	9,684	-0.018	-0.029	-0.008	0.001	-0.001	-0.003	0.001	0.37
Depression	9,376	0.022	-0.002	0.046	0.07	-0.008	-0.022	0.006	0.28
Cancer	9,681	-0.006	-0.017	0.006	0.32	-0.005	-0.011	0.000	0.06
Died	9,699	-0.014	-0.023	-0.004	0.009	-0.007	-0.010	-0.003	<0.001
Ever smoked	9,681	-0.222	-0.246	-0.198	<0.001	-0.010	-0.030	0.011	0.34
Currently smoke	9,681	-0.171	-0.195	-0.146	<0.001	0.002	-0.006	0.009	0.61
Income over £18k	8,904	0.090	0.079	0.101	<0.001	0.000	-0.006	0.007	0.93
Income over £31k	8,904	0.276	0.242	0.310	<0.001	0.009	-0.008	0.026	0.29
Income over £52k	8,904	0.301	0.261	0.341	<0.001	0.036	0.028	0.043	<0.001
Income over £100k	8,904	0.146	0.117	0.175	<0.001	0.012	0.003	0.021	0.01
Grip strength (kg)*	9,618	0.850	0.184	1.516	0.01	0.521	0.337	0.705	<0.001
Arterial Stiffness*	3,674	-1.024	-1.357	-0.692	<0.001	-0.113	-0.250	0.024	0.10
Height (cm)*	9,666	1.789	1.405	2.174	<0.001	0.167	-0.030	0.364	0.09
BMI (kg/m^2)*	9,656	-0.979	-1.328	-0.631	<0.001	-0.082	-0.232	0.068	0.27
Diastolic blood pressure (mmHg)*	9,405	-0.667	-1.656	0.321	0.18	-0.103	-0.400	0.194	0.48
Systolic blood pressure (mmHg)*	9,404	-0.853	-2.237	0.530	0.21	-0.359	-0.775	0.057	0.09
Intelligence (0 to 13)*	3,644	1.790	1.431	2.149	<0.001	-0.010	-0.121	0.100	0.85
Happiness (0 to 5 Likert)*	3,687	-0.026	-0.131	0.080	0.62	-0.021	-0.055	0.013	0.22
Alcohol consumption (1 low, 5 high)*	9,692	0.292	0.174	0.411	<0.001	0.016	-0.015	0.047	0.30
Hours of television viewing per day*	9,334	-0.881	-0.983	-0.778	<0.001	-0.074	-0.117	-0.030	0.002
Moderate exercise (days/week)*	9,421	-0.670	-0.880	-0.461	<0.001	0.084	0.019	0.150	0.01
Vigorous exercise (days/week)*	9,395	-0.276	-0.415	-0.138	<0.001	0.045	-0.012	0.101	0.12

Notes: * denotes mean differences. Estimated using robust linear regression, with standard errors clustered by year and month of birth. All estimates adjust for month of birth and sex. No weighting.

Supplementary Table 11: The associations between remaining in school after age 15, and attending school after the raising of the school leaving age (ROSLA) and outcomes for FEMALES, UNWEIGHTED.

		Left school after age 15				Affected by ROSLA			
	N	Risk/Mean difference	95% Confidence interval Lower	Upper	P-value	Risk/Mean difference	95% Confidence interval Lower	Upper	P-value
Hypertension	12,214	-0.035	-0.054	-0.015	0.001	-0.012	-0.025	0.002	0.09
Diabetes	12,399	-0.007	-0.015	0.001	0.08	-0.005	-0.008	-0.002	0.003
Stroke	12,426	-0.007	-0.012	-0.001	0.02	-0.003	-0.005	-0.002	<0.001
Heart attack	12,426	-0.005	-0.009	0.000	0.03	-0.002	-0.004	-0.001	<0.001
Depression	11,709	0.038	0.022	0.054	<0.001	-0.004	-0.015	0.007	0.50
Cancer	12,330	-0.006	-0.025	0.012	0.50	-0.003	-0.011	0.005	0.43
Died	12,439	-0.004	-0.008	0.001	0.12	-0.002	-0.005	0.001	0.11
Ever smoked	12,405	-0.192	-0.227	-0.157	<0.001	-0.004	-0.013	0.004	0.30
Currently smoke	12,405	-0.116	-0.134	-0.099	<0.001	0.003	-0.003	0.010	0.29
Income over £18k	11,017	0.070	0.059	0.081	<0.001	-0.003	-0.014	0.007	0.53
Income over £31k	11,017	0.240	0.222	0.258	<0.001	0.009	-0.002	0.021	0.12
Income over £52k	11,017	0.290	0.255	0.326	<0.001	0.018	0.011	0.025	<0.001
Income over £100k	11,017	0.196	0.164	0.228	<0.001	0.004	-0.004	0.012	0.32
Grip strength (kg)*	12,371	1.501	1.167	1.836	<0.001	0.336	0.189	0.482	<0.001
Arterial Stiffness*	4,863	-0.550	-0.759	-0.341	<0.001	0.000	-0.127	0.127	1.00
Height (cm)*	12,411	1.756	1.403	2.110	<0.001	0.008	-0.091	0.106	0.87
BMI (kg/m^2)*	12,399	-1.425	-1.761	-1.088	<0.001	-0.146	-0.304	0.011	0.07
Diastolic blood pressure (mmHg)*	12,089	-1.054	-1.540	-0.568	<0.001	0.140	-0.211	0.492	0.42
Systolic blood pressure (mmHg)*	12,088	-2.345	-3.267	-1.424	<0.001	-0.480	-0.964	0.003	0.05
Intelligence (0 to 13)*	4,896	1.546	1.351	1.740	<0.001	-0.011	-0.091	0.070	0.79
Happiness (0 to 5 Likert)*	4,939	0.031	-0.034	0.097	0.33	-0.016	-0.042	0.010	0.21
Alcohol consumption (1 low, 5 high)*	12,431	0.328	0.240	0.416	<0.001	-0.011	-0.057	0.035	0.62
Hours of television viewing per day*	11,872	-0.796	-0.912	-0.679	<0.001	-0.041	-0.081	0.000	0.05
Moderate exercise (days/week)*	11,909	-0.317	-0.493	-0.141	0.001	0.014	-0.056	0.083	0.69
Vigorous exercise (days/week)*	11,984	-0.007	-0.131	0.116	0.90	0.009	-0.033	0.051	0.67

Notes: * denotes mean differences. ROSLA= Raising of the school leaving age. Estimated using robust linear regression, with standard errors clustered by year and month of birth. All estimates adjust for the month of birth and sex. The same sample was used for both the conventional linear regression and ROSLA analyses. No weighting.

Supplementary Table 12: The effects of remaining in school after age 15, instrumental variable regression (left) and conventional regression (right)

		Instrumental variable regression						Conventional linear regression		
	N	Risk/Mean difference	95% Confidence interval Lower	Upper	P-value	Hausman p-value	Partial F-stat	Risk/Mean difference	95% Confidence interval Lower	Upper
Hypertension	21,768	-0.080	-0.112	-0.047	1.6E-6^	0.05	2126	-0.039	-0.057	-0.021
Diabetes	22,049	-0.036	-0.047	-0.024	2.2E-9^	0.03	2187	-0.019	-0.031	-0.008
Stroke	22,110	-0.013	-0.019	-0.006	6.9E-5^	0.13	2202	-0.006	-0.011	-0.002
Heart attack	22,110	-0.012	-0.016	-0.007	6.5E-8^	0.80	2202	-0.011	-0.017	-0.005
Depression	21,085	-0.012	-0.043	0.019	0.45	0.01	2028	0.031	0.017	0.045
Cancer	22,011	-0.023	-0.048	0.002	0.07	0.22	2182	-0.006	-0.020	0.008
Died	22,138	-0.020	-0.030	-0.009	1.9E-4^	0.02	2206	-0.008	-0.013	-0.003
Ever smoked	22,086	-0.099	-0.144	-0.055	1.2E-5^	9.6E-4	2202	-0.205	-0.228	-0.183
Currently smoke	22,086	-0.038	-0.060	-0.016	8.4E-4^	2.7E-5	2202	-0.141	-0.155	-0.127
Income over £18k	19,921	0.111	0.089	0.133	<6.0E-39^	0.004	1866	0.174	0.154	0.195
Income over £31k	19,921	0.240	0.218	0.262	<6.0E-39^	0.007	1866	0.296	0.274	0.318
Income over £52k	19,921	0.146	0.098	0.193	1.7E-9^	9.5E-4	1866	0.256	0.239	0.274
Income over £100k	19,921	0.025	-0.001	0.051	0.06	0.003	1866	0.079	0.071	0.087
Grip strength (kg)*	21,989	2.410	2.064	2.757	<6.0E-39^	4.2E-4	2161	1.215	0.947	1.484
Arterial Stiffness*	8,537	-0.531	-1.005	-0.058	0.03^	0.38	788	-0.750	-0.931	-0.570
Height (cm)*	22,077	1.244	0.861	1.627	1.9E-10^	0.03	2196	1.765	1.517	2.014
BMI (kg/m^2)*	22,055	-1.092	-1.403	-0.781	5.9E-12^	0.45	2197	-1.235	-1.478	-0.992
Diastolic blood pressure (mmHg)*	21,494	-0.301	-1.213	0.610	0.52	0.17	2116	-0.877	-1.377	-0.377
Systolic blood pressure (mmHg)*	21,492	-2.674	-3.928	-1.420	2.9E-5^	0.07	2114	-1.688	-2.444	-0.933
Intelligence (0 to 13)*	8,540	0.696	0.453	0.940	2.0E-8^	1.7E-5	791	1.653	1.458	1.849
Happiness (0 to 5 Likert)*	8,626	-0.071	-0.173	0.032	0.18	0.16	807	0.008	-0.047	0.062
Alcohol consumption (1 low, 5 high)*	22,123	0.157	0.048	0.267	0.005^	0.02	2204	0.316	0.229	0.404
Hours of television viewing per day*	21,206	-0.589	-0.723	-0.456	<6.0E-39^	0.005	2140	-0.834	-0.916	-0.752
Moderate exercise (days/week)*	21,330	0.020	-0.166	0.207	0.83	6.2E-4	2017	-0.480	-0.639	-0.321
Vigorous exercise (days/week)*	21,379	0.044	-0.078	0.165	0.48	0.03	2011	-0.129	-0.207	-0.051

Notes: * denotes mean differences. Estimated using robust linear regression, with standard errors clustered by year and month of birth. All estimates adjust for the month of birth and sex. ^Exceeds Benjamini and Hochberg (1995) corrected threshold for false discovery rate at δ=0.05 across 25 outcomes.(32) Inverse probability weights used to correct for under-sampling of participants who left school at age 15

(weight=1.8857). The difference in outcomes between those who remained and left school at age 15 are included for comparison, and may suffer from residual confounding.

Supplementary Table 13: The effects of remaining in school after age 15, instrumental variable regression (left) and conventional regression (right), MALES

		Instrumental variable regression						Conventional linear regression		
	N	Mean/risk difference	95% Confidence interval Lower	Upper	P-value	Hausman p-value	Partial F-stat	Mean/risk difference	95% Confidence interv Lower	Upper
Hypertension	9,554	-0.091	-0.120	-0.062	4.6E-10	0.03	1013	-0.043	-0.073	-0.014
Diabetes	9,650	-0.047	-0.065	-0.030	1.7E-7	0.33	1034	-0.035	-0.055	-0.015
Stroke	9,684	-0.007	-0.018	0.004	0.21	0.78	1042	-0.005	-0.013	0.002
Heart attack	9,684	-0.010	-0.018	-0.002	0.01	0.10	1042	-0.018	-0.029	-0.008
Depression	9,376	-0.022	-0.079	0.034	0.44	0.13	981	0.022	-0.002	0.045
Cancer	9,681	-0.024	-0.044	-0.003	0.03	0.15	1043	-0.006	-0.017	0.006
Died	9,699	-0.029	-0.043	-0.015	3.5E-5	0.05	1044	-0.014	-0.023	-0.004
Ever smoked	9,681	-0.111	-0.192	-0.031	0.007	0.02	1038	-0.222	-0.246	-0.198
Currently smoke	9,681	-0.048	-0.078	-0.018	0.002	4.4E-5	1038	-0.170	-0.195	-0.146
Income over £18k	8,904	0.115	0.077	0.154	3.0E-9	0.22	870	0.146	0.117	0.175
Income over £31k	8,904	0.279	0.241	0.318	<6.0E-39	0.39	870	0.302	0.263	0.341
Income over £52k	8,904	0.160	0.093	0.228	2.9E-6	0.01	870	0.276	0.243	0.310
Income over £100k	8,904	0.040	0.015	0.065	0.002	0.004	870	0.090	0.079	0.100
Grip strength (kg)*	9,618	2.592	1.787	3.396	2.7E-10	9.5E-4	1018	0.852	0.196	1.508
Arterial Stiffness*	3,674	-0.938	-1.558	-0.317	0.003	0.78	350	-1.029	-1.359	-0.700
Height (cm)*	9,666	1.653	0.849	2.457	5.6E-5	0.76	1038	1.793	1.414	2.172
BMI (kg/m^2)*	9,656	-0.859	-1.486	-0.233	0.007	0.68	1036	-0.985	-1.325	-0.644
Diastolic blood pressure (mmHg)*	9,405	-1.022	-2.389	0.346	0.14	0.61	1002	-0.673	-1.653	0.307
Systolic blood pressure (mmHg)*	9,404	-2.482	-4.227	-0.738	0.005	0.09	1000	-0.868	-2.238	0.502
Intelligence (0 to 13)*	3,644	0.731	0.290	1.172	0.001	0.002	346	1.794	1.446	2.143
Happiness (0 to 5 Likert)*	3,687	-0.130	-0.283	0.023	0.10	0.23	352	-0.026	-0.131	0.078
Alcohol consumption (1 low, 5 high)*	9,692	0.233	0.098	0.369	7.2E-4	0.51	1042	0.295	0.180	0.410
Hours of television viewing per day*	9,334	-0.693	-0.849	-0.538	<6.0E-39	0.08	994	-0.883	-0.983	-0.782
Moderate exercise (days/week)*	9,421	0.100	-0.122	0.321	0.38	4.4E-4	965	-0.675	-0.877	-0.473
Vigorous exercise (days/week)*	9,395	0.044	-0.154	0.242	0.66	0.02	943	-0.279	-0.416	-0.142

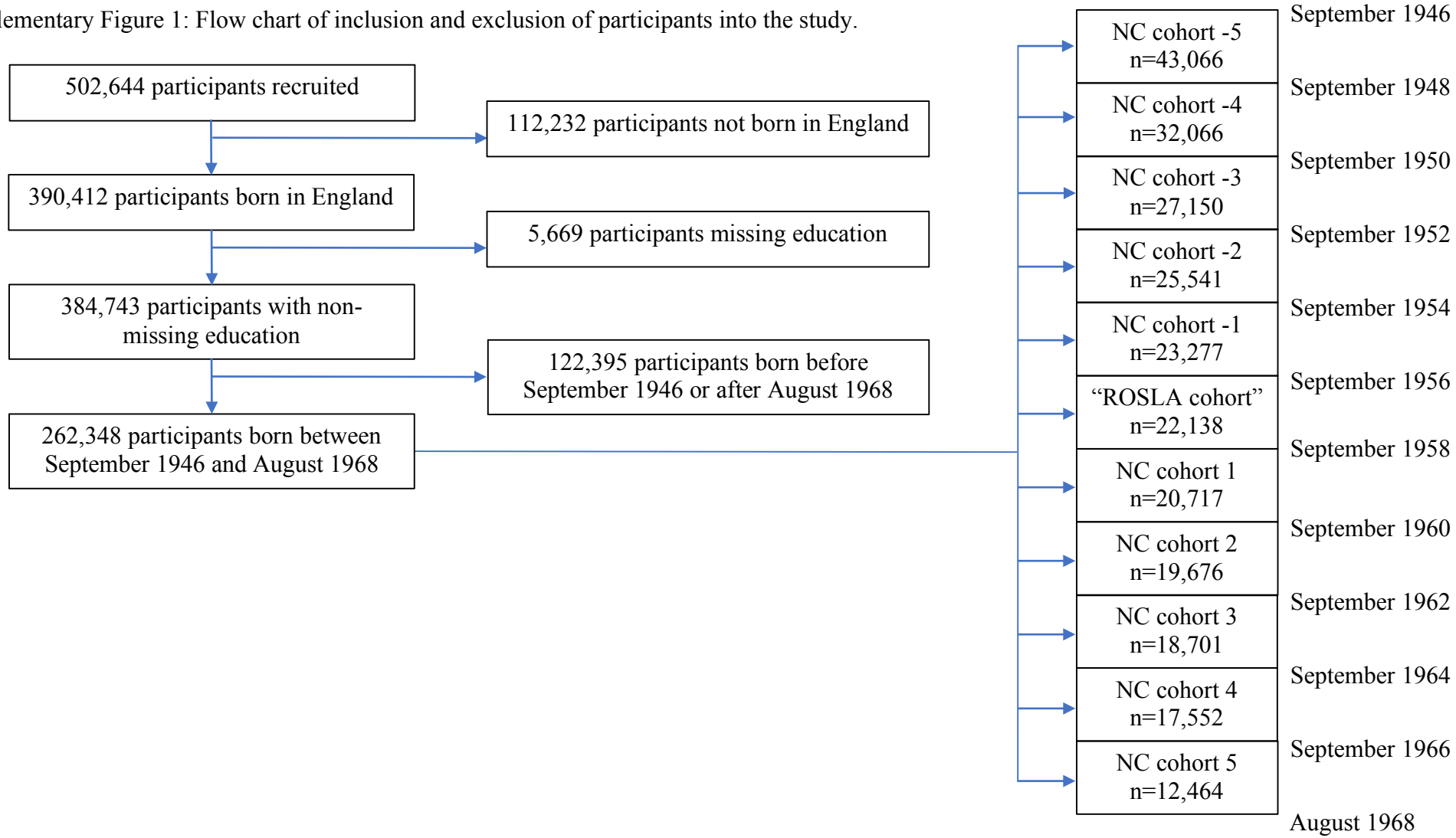
Notes: * denotes mean differences. Estimated using robust linear regression, with standard errors clustered by year and month of birth. All estimates adjust for month of birth and sex. Inverse probability weights used to correct for under-sampling of participants who left school at age 15 (weight=1.8857).

Supplementary Table 14: The effects of remaining in school after age 15, instrumental variable regression (left) and conventional regression (right), FEMALES

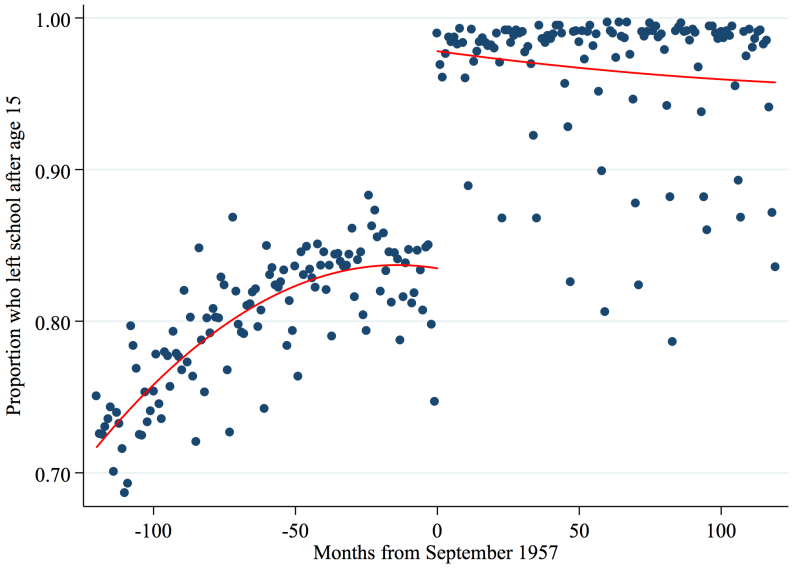
		Instrumental variable regression						Conventional linear regression		
	N	Mean/risk difference	95% Confidence interval Lower	Upper	P-value	Hausman p-value	Partial F-stat	Mean/risk difference	95% Confidence interval Lower	Upper
Hypertension	12,214	-0.070	-0.129	-0.011	0.02	0.25	1112	-0.035	-0.055	-0.016
Diabetes	12,399	-0.026	-0.038	-0.014	2.3E-5	0.01	1152	-0.007	-0.015	0.001
Stroke	12,426	-0.018	-0.023	-0.012	5.2E-10	0.03	1159	-0.007	-0.012	-0.002
Heart attack	12,426	-0.013	-0.018	-0.009	2.2E-8	0.01	1159	-0.005	-0.009	-0.001
Depression	11,709	-0.004	-0.053	0.045	0.86	0.08	1048	0.038	0.023	0.054
Cancer	12,330	-0.022	-0.056	0.012	0.20	0.37	1139	-0.006	-0.025	0.012
Died	12,439	-0.012	-0.025	0.001	0.06	0.13	1162	-0.004	-0.008	0.001
Ever smoked	12,405	-0.087	-0.127	-0.047	2.0E-5	3.4E-4	1163	-0.192	-0.226	-0.158
Currently smoke	12,405	-0.027	-0.057	0.004	0.08	9.5E-5	1163	-0.117	-0.134	-0.099
Income over £18k	11,017	0.107	0.073	0.142	5.9E-10	0.002	994	0.196	0.165	0.228
Income over £31k	11,017	0.210	0.179	0.241	<6.0E-39	0.004	994	0.291	0.256	0.325
Income over £52k	11,017	0.137	0.087	0.188	1.1E-7	0.001	994	0.240	0.222	0.258
Income over £100k	11,017	0.014	-0.030	0.058	0.54	0.03	994	0.070	0.060	0.080
Grip strength (kg)*	12,371	2.283	1.683	2.883	8.6E-14	0.03	1143	1.503	1.174	1.832
Arterial Stiffness*	4,863	-0.275	-0.850	0.299	0.35	0.35	436	-0.553	-0.761	-0.346
Height (cm)*	12,411	0.915	0.477	1.354	4.3E-5	0.004	1157	1.753	1.402	2.105
BMI (kg/m^2)*	12,399	-1.284	-1.947	-0.621	1.5E-4	0.67	1161	-1.425	-1.755	-1.094
Diastolic blood pressure (mmHg)*	12,089	0.268	-1.171	1.707	0.71	0.07	1113	-1.051	-1.532	-0.569
Systolic blood pressure (mmHg)*	12,088	-2.849	-4.921	-0.776	0.007	0.62	1113	-2.345	-3.245	-1.445
Intelligence (0 to 13)*	4,896	0.664	0.336	0.991	7.1E-5	7.2E-4	444	1.549	1.357	1.741
Happiness (0 to 5 Likert)*	4,939	-0.025	-0.137	0.088	0.67	0.38	453	0.032	-0.032	0.097
Alcohol consumption (1 low, 5 high)*	12,431	0.092	-0.120	0.303	0.40	0.03	1162	0.330	0.244	0.416
Hours of television viewing per day*	11,872	-0.509	-0.691	-0.327	4.2E-8	0.005	1146	-0.796	-0.910	-0.682
Moderate exercise (days/week)*	11,909	-0.049	-0.400	0.302	0.79	0.12	1051	-0.320	-0.489	-0.152
Vigorous exercise (days/week)*	11,984	0.034	-0.149	0.218	0.71	0.63	1068	-0.008	-0.131	0.114

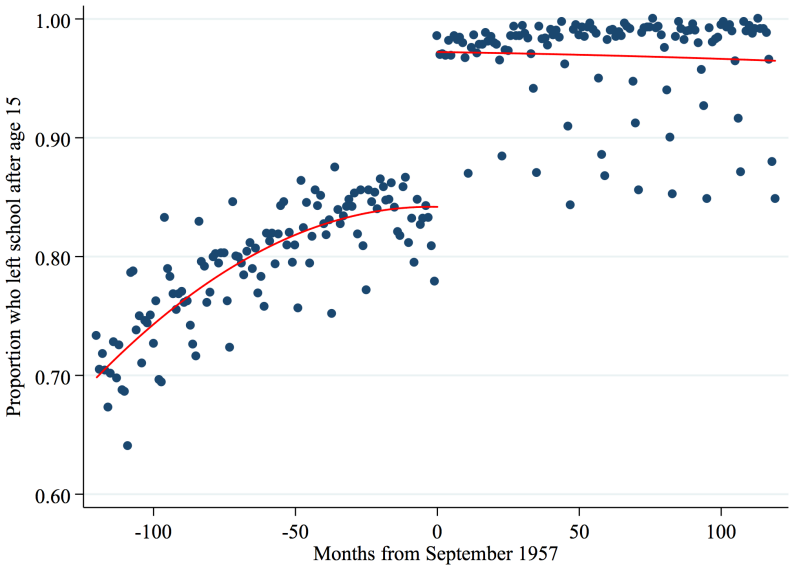
Notes: * denotes mean differences. Estimated using robust linear regression, with standard errors clustered by year and month of birth. All estimates adjust for month of birth and sex. Inverse probability weights used to correct for under-sampling of participants who left school at age 15 (weight=1.8857).

Supplementary Figure 1: Flow chart of inclusion and exclusion of participants into the study.

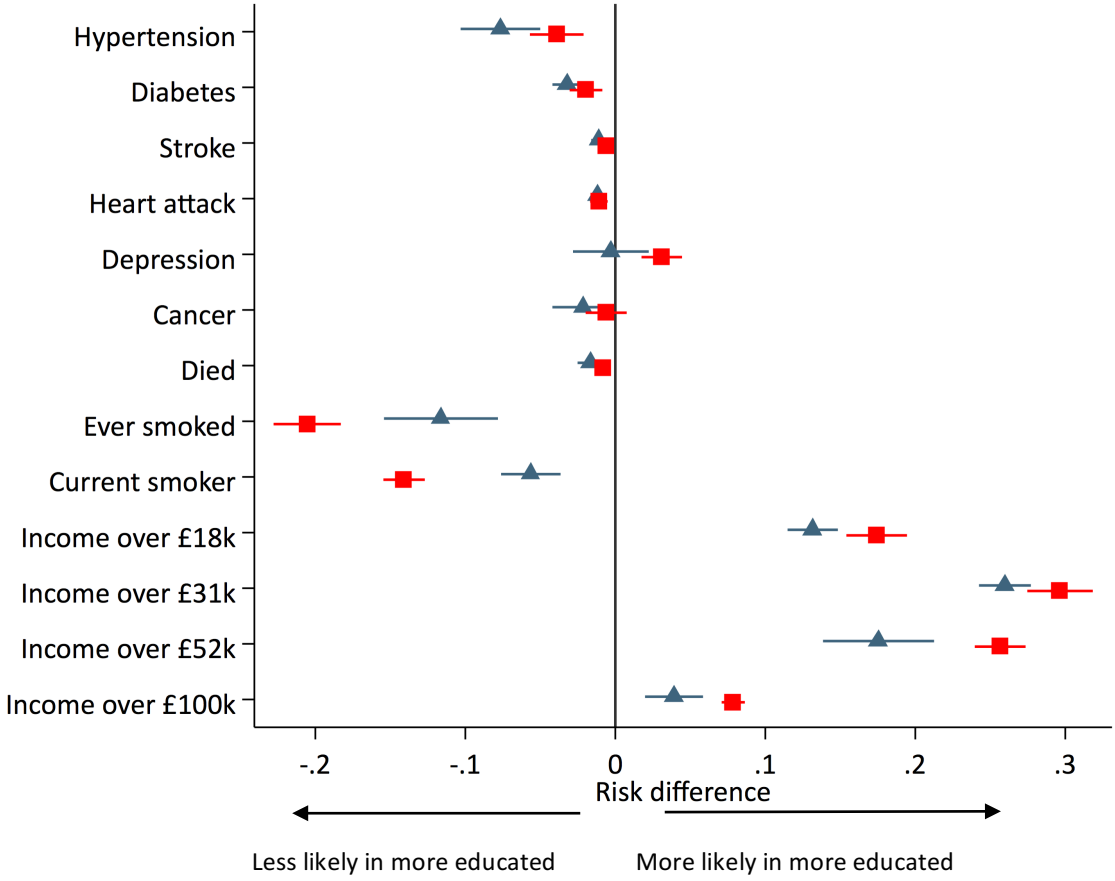


Supplementary Figure 2. Effects of the reform on the proportion of males (top) and females (bottom) remaining in education after the age of 15. Each dot represents the unweighted proportion of females born in each month who remained in school past the age of 15. N=176,931 and 207,812 for males and females respectively. The red line is calculated using a the outcome using a linear regression of the outcome on time and time squared either side of the reform.



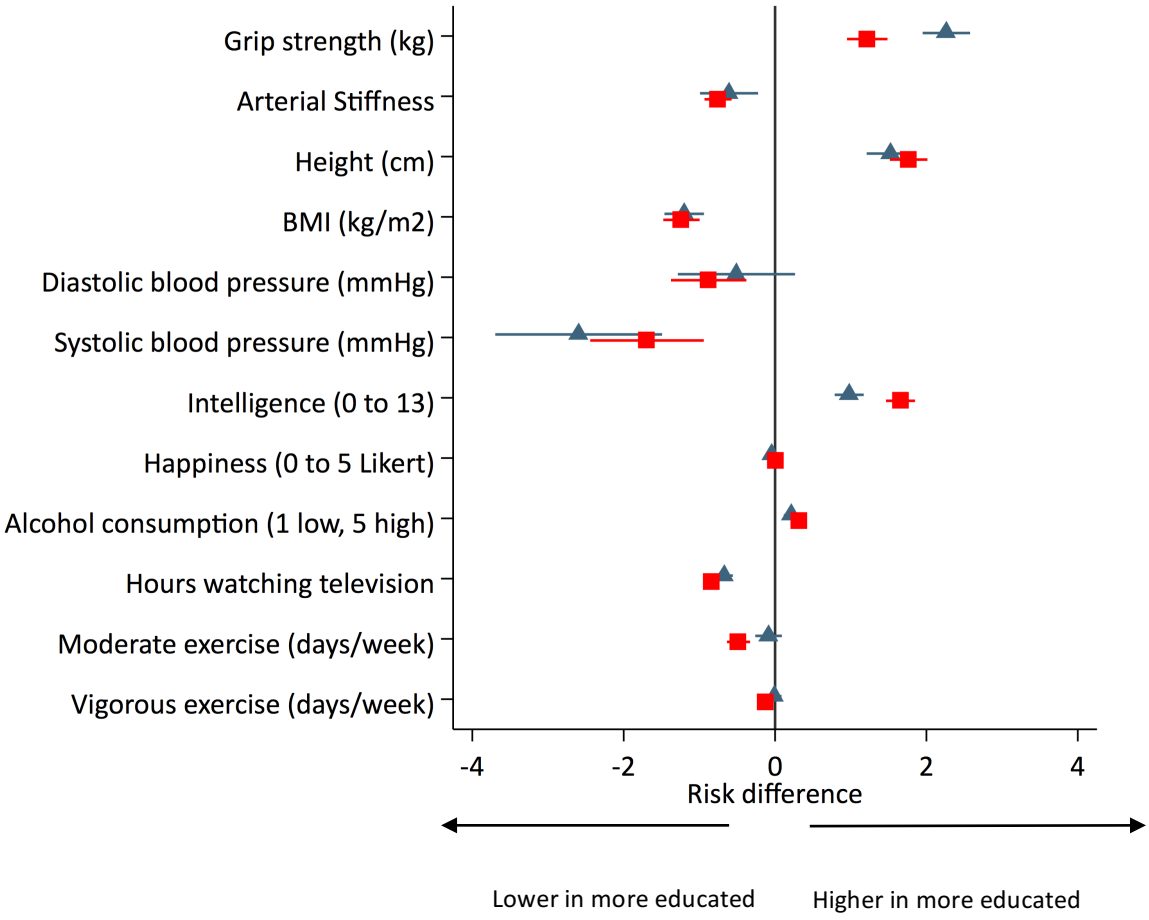


Supplementary Figure 3: Effect of remaining in school after age 15 on risk of outcomes. Estimated by actual education attainment (■), and using the raising of the school leaving age as an instrumental variable (▲).



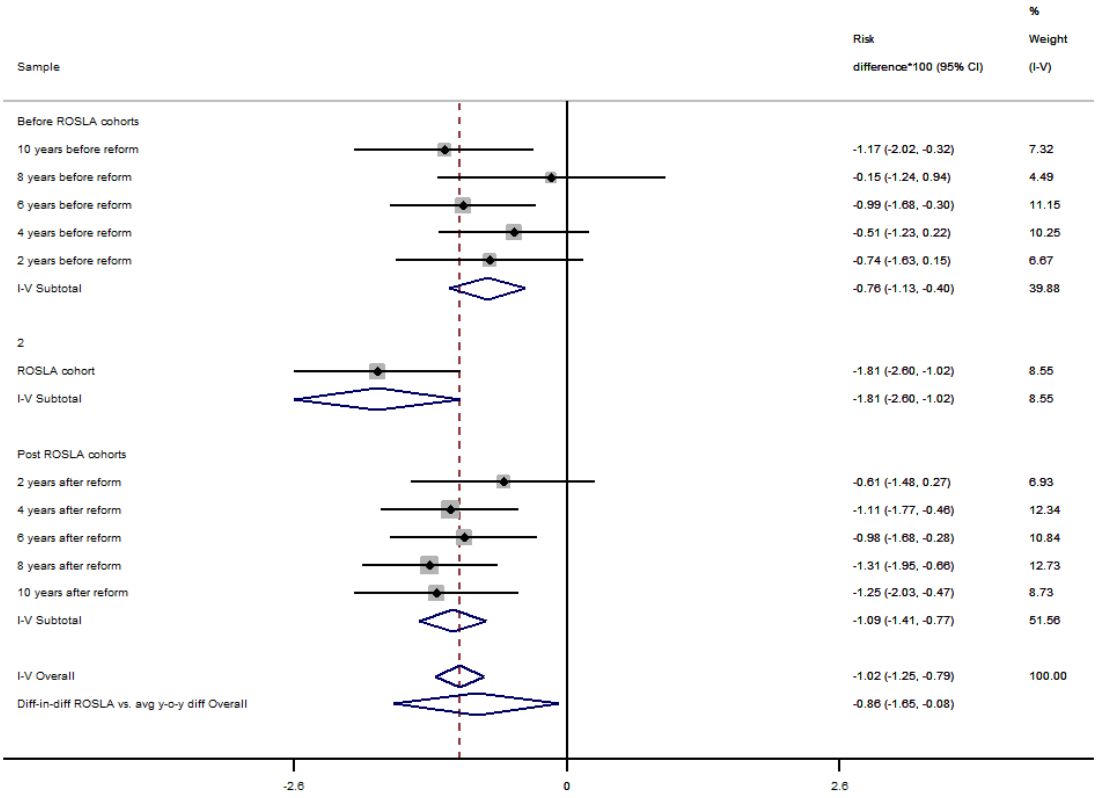
Notes: Results also displayed in Table S12. Estimated using robust linear or instrumental variables regression, with standard errors clustered by month of birth. 12 month bandwidth and inverse probability weights. Max N=22,138.

Supplementary Figure 4: Effect of remaining in school after age 15 on mean outcomes. Estimated by actual education attainment (■), and using the raising of the school leaving age as an instrumental variable (▲).

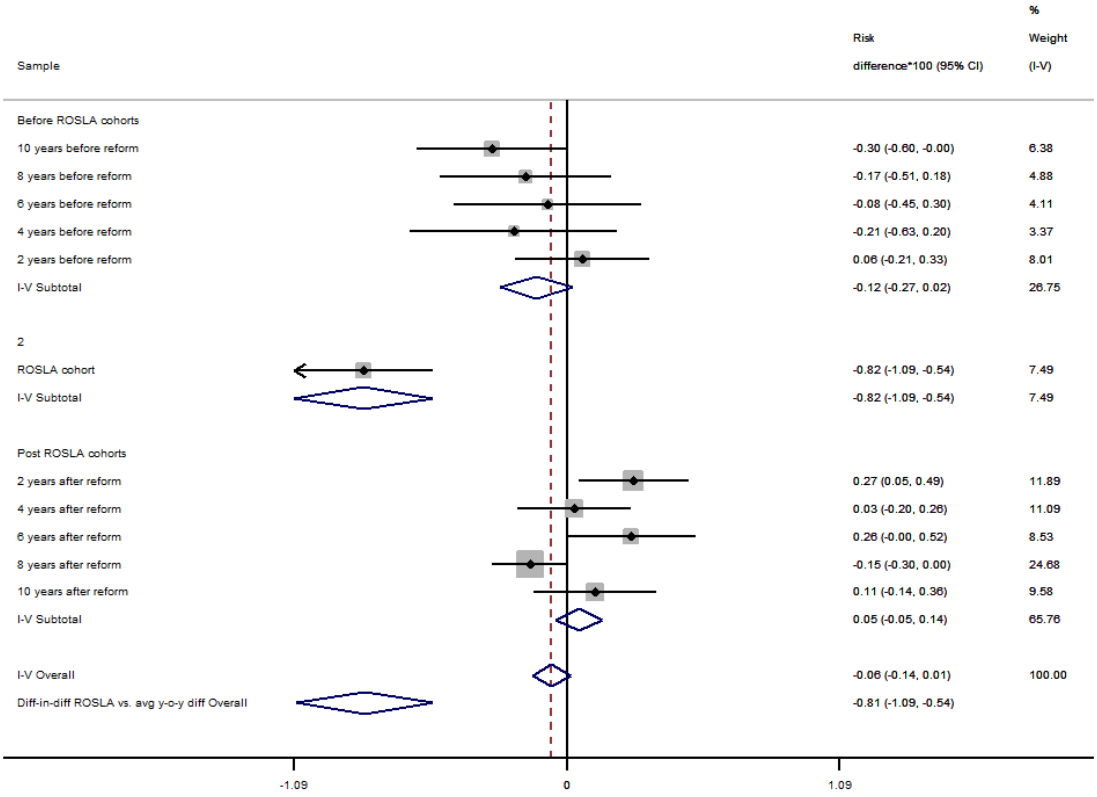


Notes: Results also displayed in Table S12. Estimated using robust linear or instrumental variables regression, with standard errors clustered by month of birth. 12 month bandwidth and inverse probability weights. Max N=22,123.

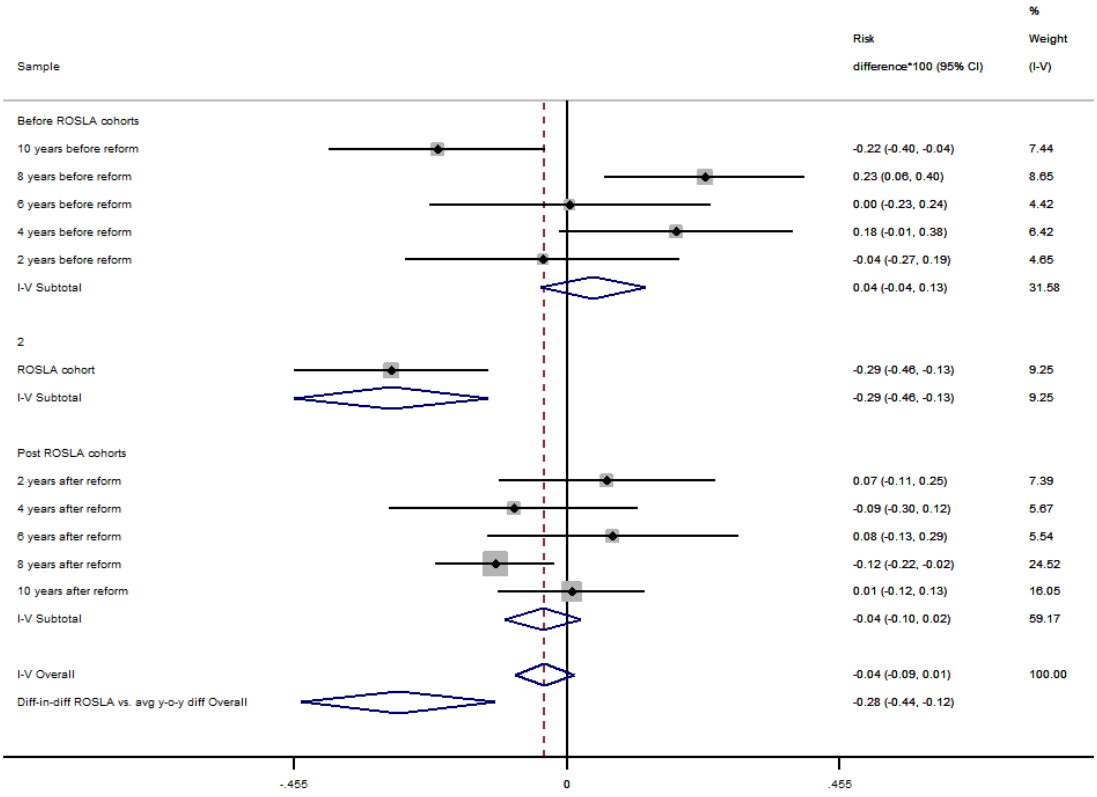
Supplementary Figure 5: The effect of the reform on risk of hypertension, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform were less likely to have hypertension than those born the year before. This year-on-year difference was larger than the average for the other years.



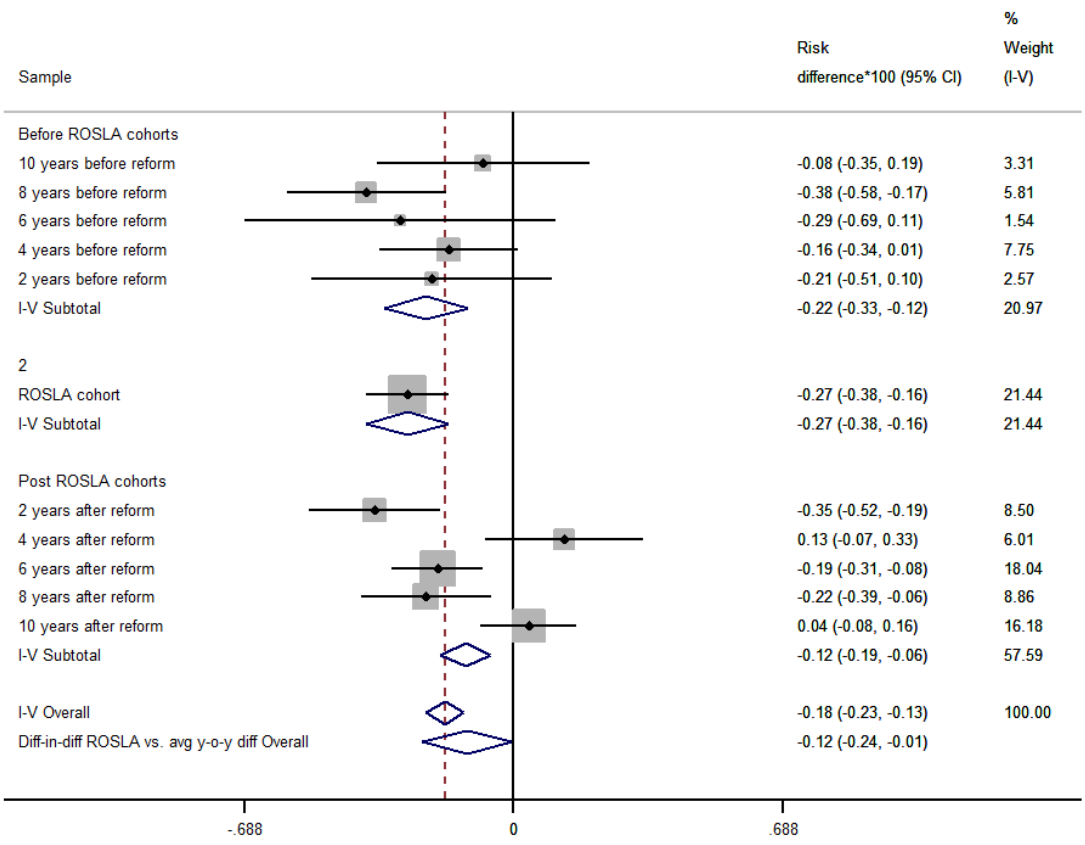
Supplementary Figure 6: The effect of the reform on risk of diabetes, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform were less likely to have diabetes than those born the year before. This year-on-year difference was larger than the average year-on-year difference.



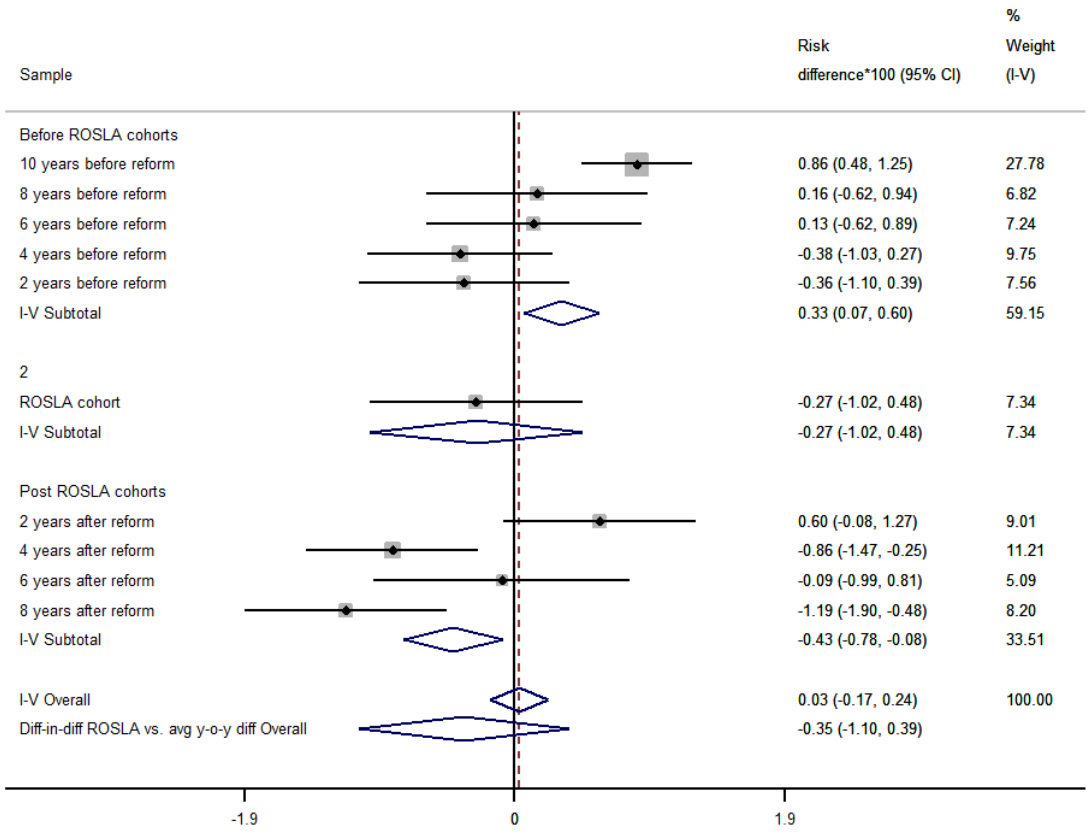
Supplementary Figure 7: The effect of the reform on risk of stroke, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform were less likely to have been diagnosed with stoke than those born the year before. This year-on-year difference was larger than the average year-on-year difference.



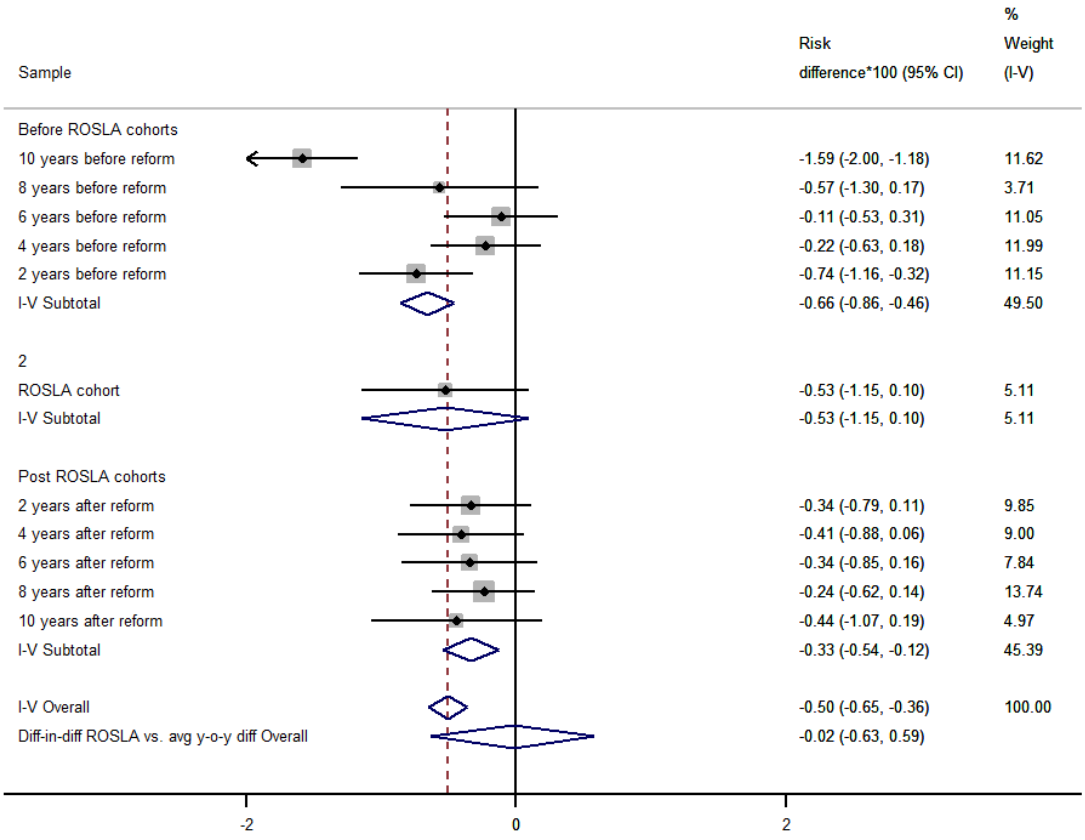
Supplementary Figure 8: The effect of the reform on risk of heart attack, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform were less likely to have had a heart attack than those born the year before. However, this difference was very similar to the average year-on-year difference, suggesting little impact of the reform.



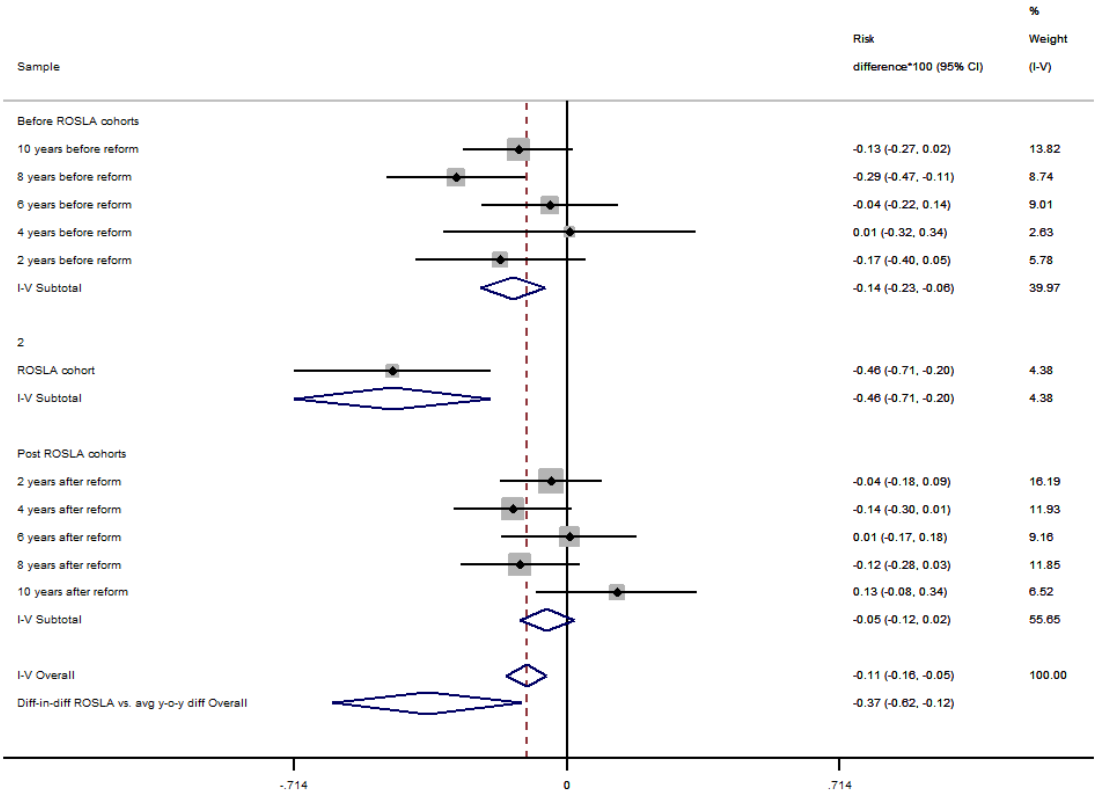
Supplementary Figure 9: The effect of the reform on risk of depression, compared to negative control "dummy reforms" in the ten years either side of the reform. The reform had little detectable effect on risk of depression.



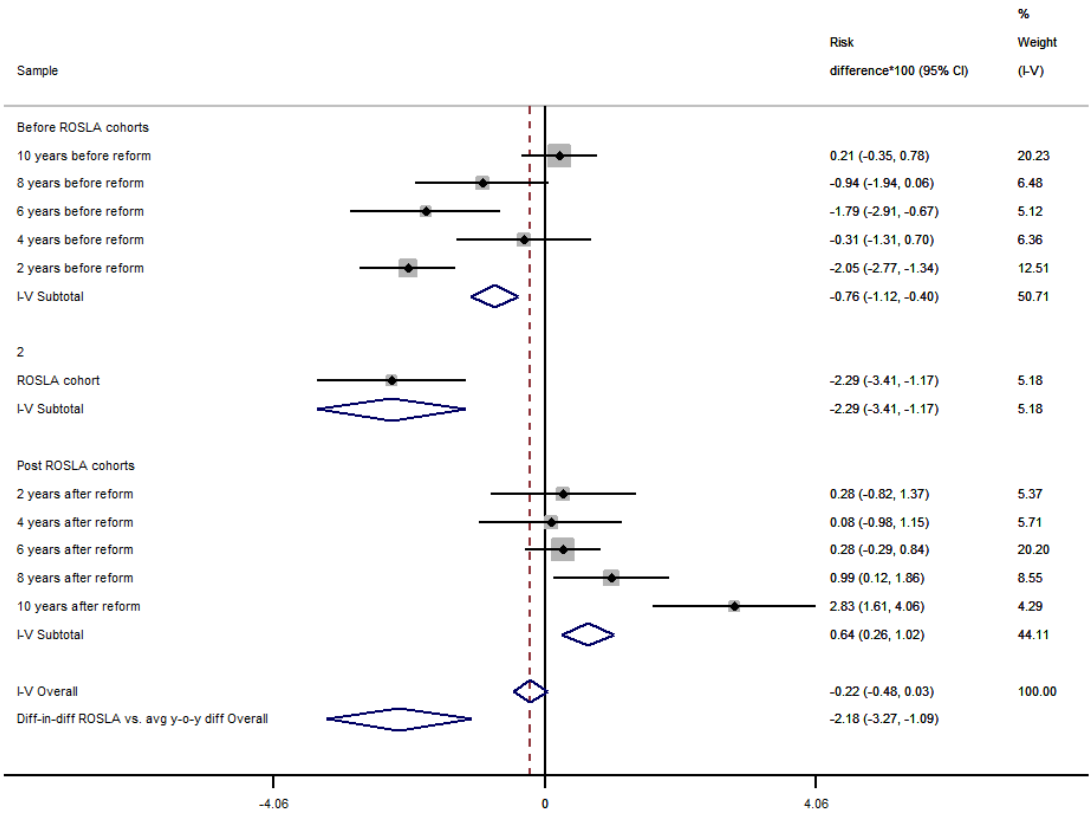
Supplementary Figure 10: The effect of the reform on risk of cancer, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform were less likely to have had cancer than those born the year before. However, this estimate is relatively imprecise. This difference was also very similar to the average year-on-year difference, suggesting little impact of the reform.



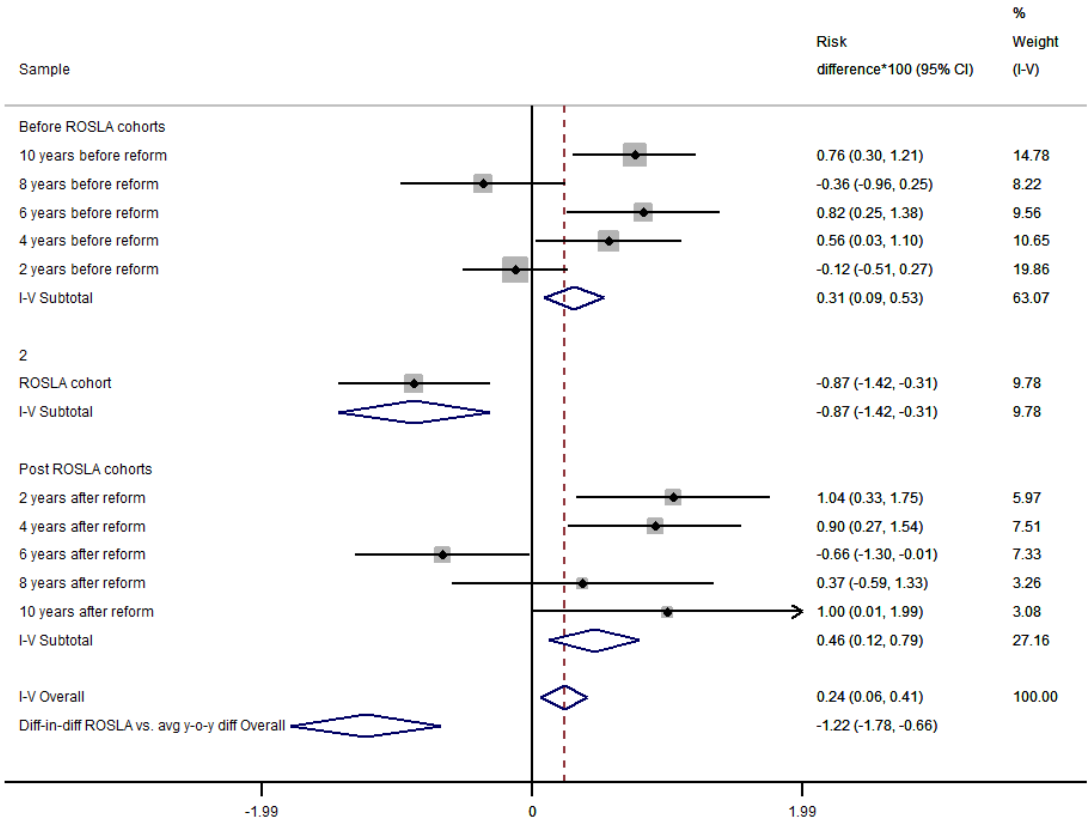
Supplementary Figure 11: The effect of the reform on risk of all-cause mortality, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform had lower mortality during follow than those born the year before. This difference was larger than the average year-on-year difference.



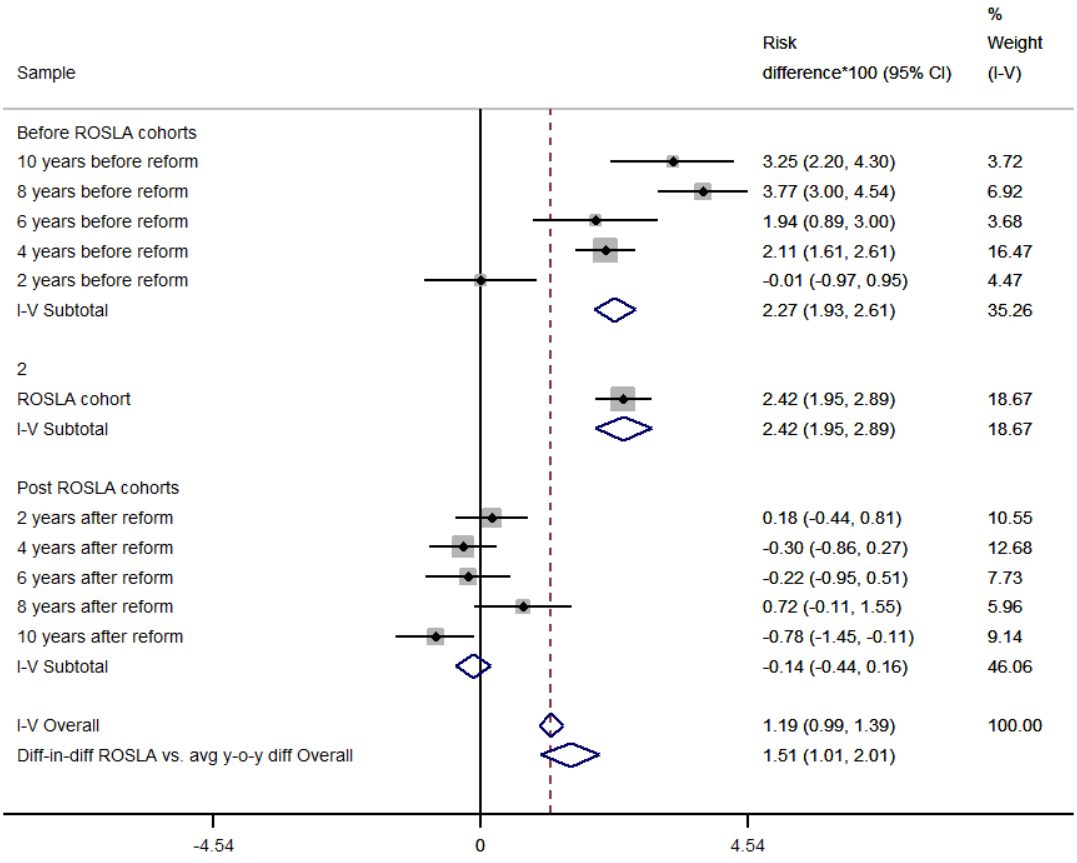
Supplementary Figure 12: The effect of the reform on risk of ever smoking, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform were less likely to have smoked than those born the year before. This difference was larger than the average year-on-year differences before and after the reform. However, there were similar year-on-year differences 2 and 6 years before the reform.



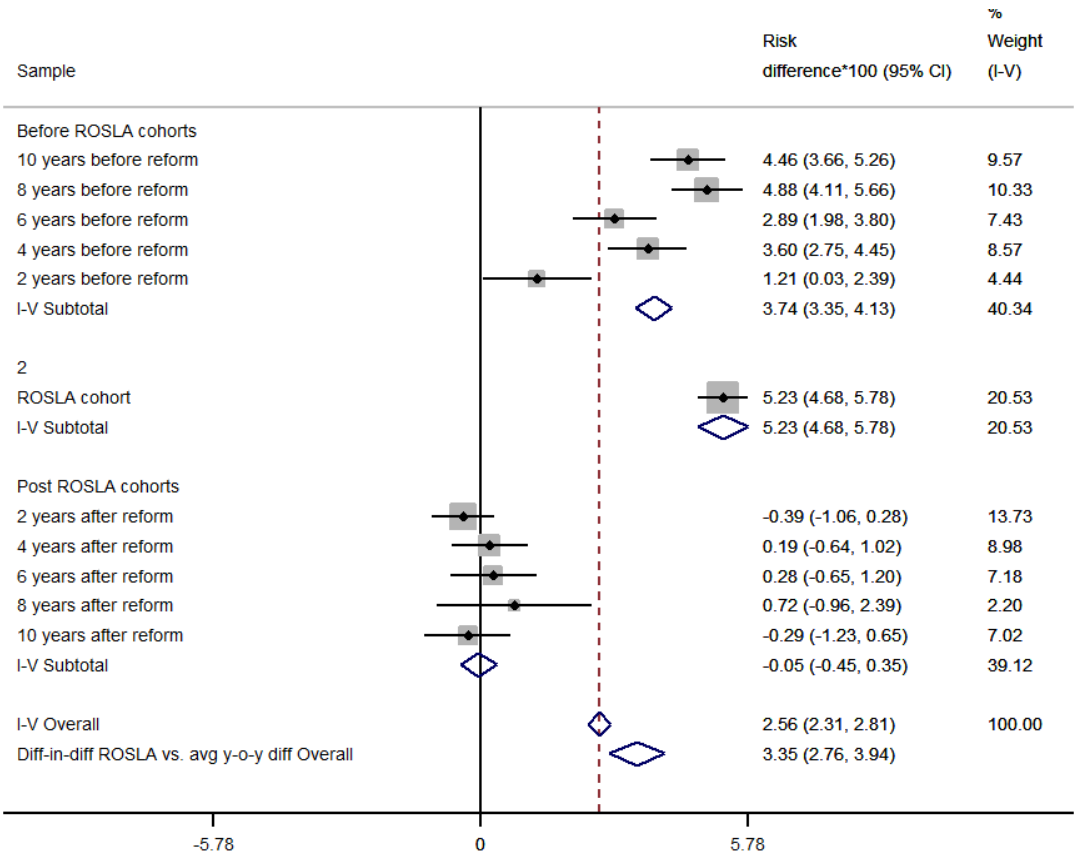
Supplementary Figure 13: The effect of the reform on risk of current smoking, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform were less likely to currently smoke than those born the year before. This difference was substantially larger than the average year-on-year differences before and after the reform. However, there were similar year-on-year differences 8 years before and 6 years after the reform.



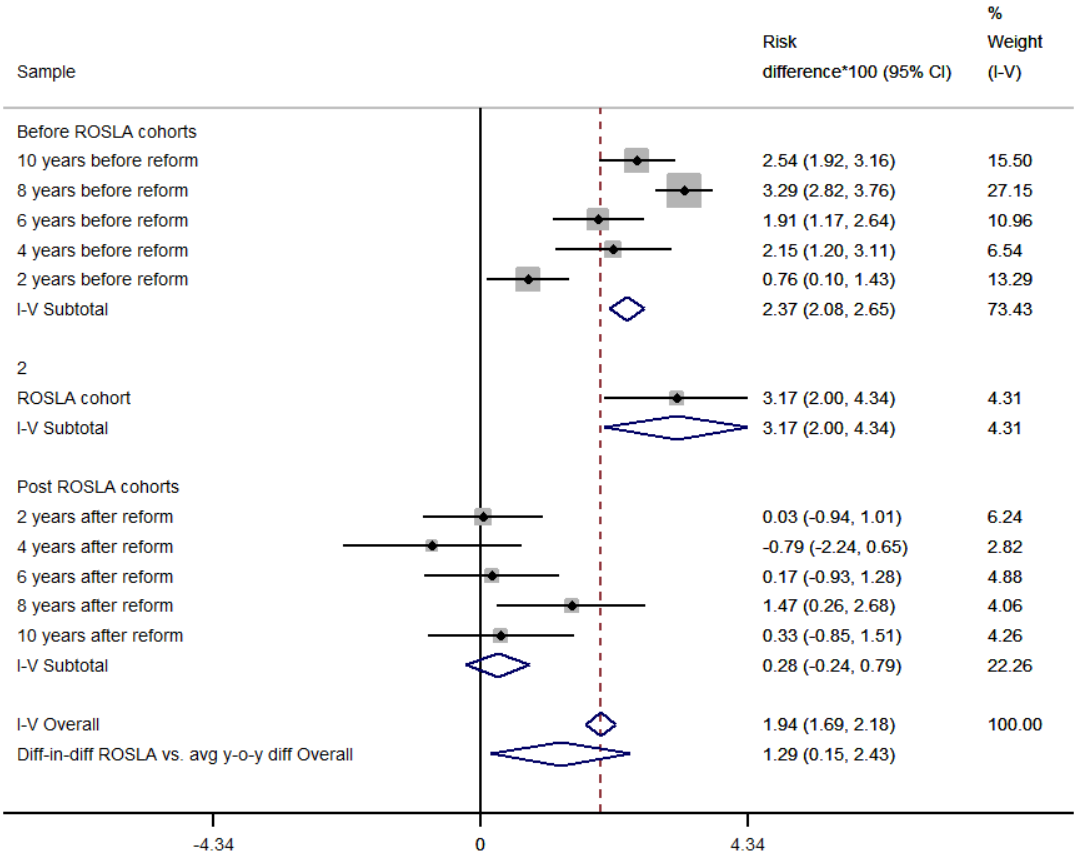
Supplementary Figure 14: The effect of the reform on likelihood of earning over £18,000, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform were more likely to earn over £18,000 a year than those born the year before. This difference was very similar to the average year-on-year difference before the reform, but substantially larger than the average year-on-year differences after the reform.



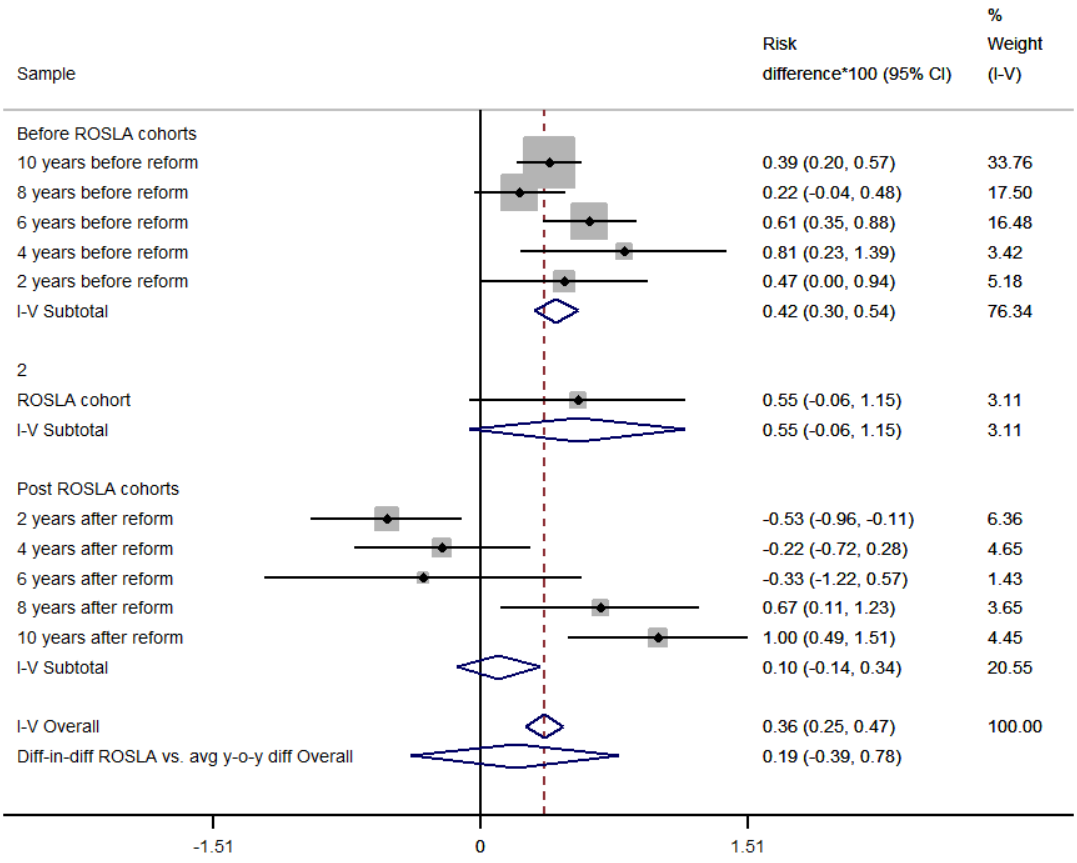
Supplementary Figure 15: The effect of the reform on likelihood of earning over £31,000, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform were more likely to earn over £31,000 a year than those born the year before. This difference was larger than the average year-on-year difference before and after the reform, but similar to the year-on-year differences 8 and 10 years before the reform.



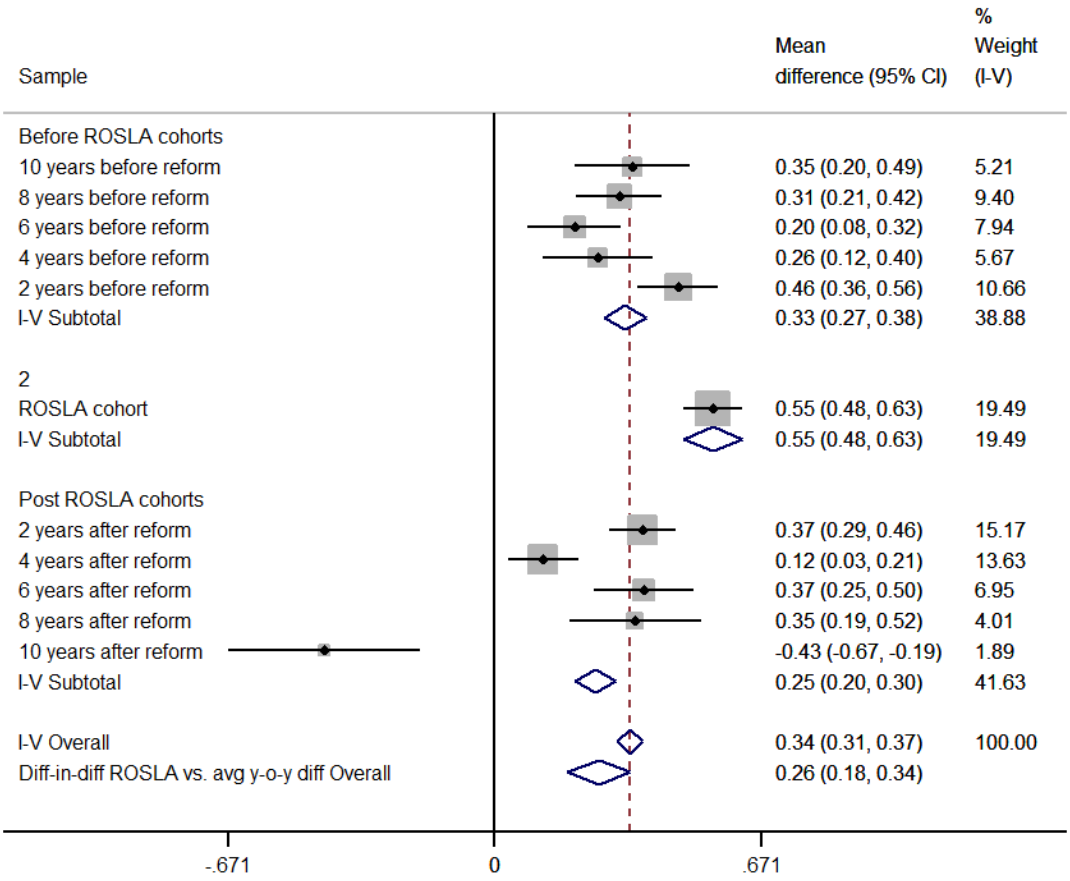
Supplementary Figure 16: The effect of the reform on likelihood of earning over £52,000, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform were more likely to earn over £52,000 a year than those born the year before. This difference was similar to the average year-on-year difference before the reform, but larger than the average year-on-year differences after the reform.



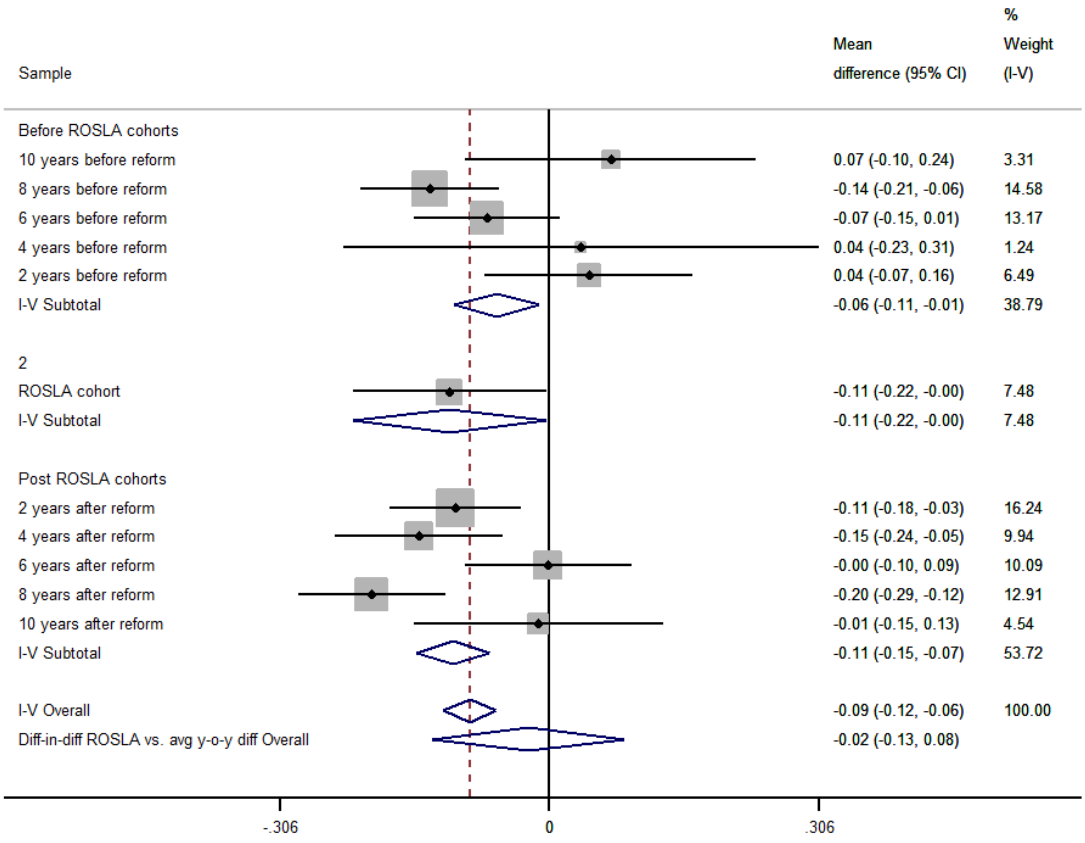
Supplementary Figure 17: The effect of the reform on likelihood of earning over £100,000, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform were more likely to earn over £100,000 a year than those born the year before. This difference was similar to the average year-on-year differences before and after the reform.



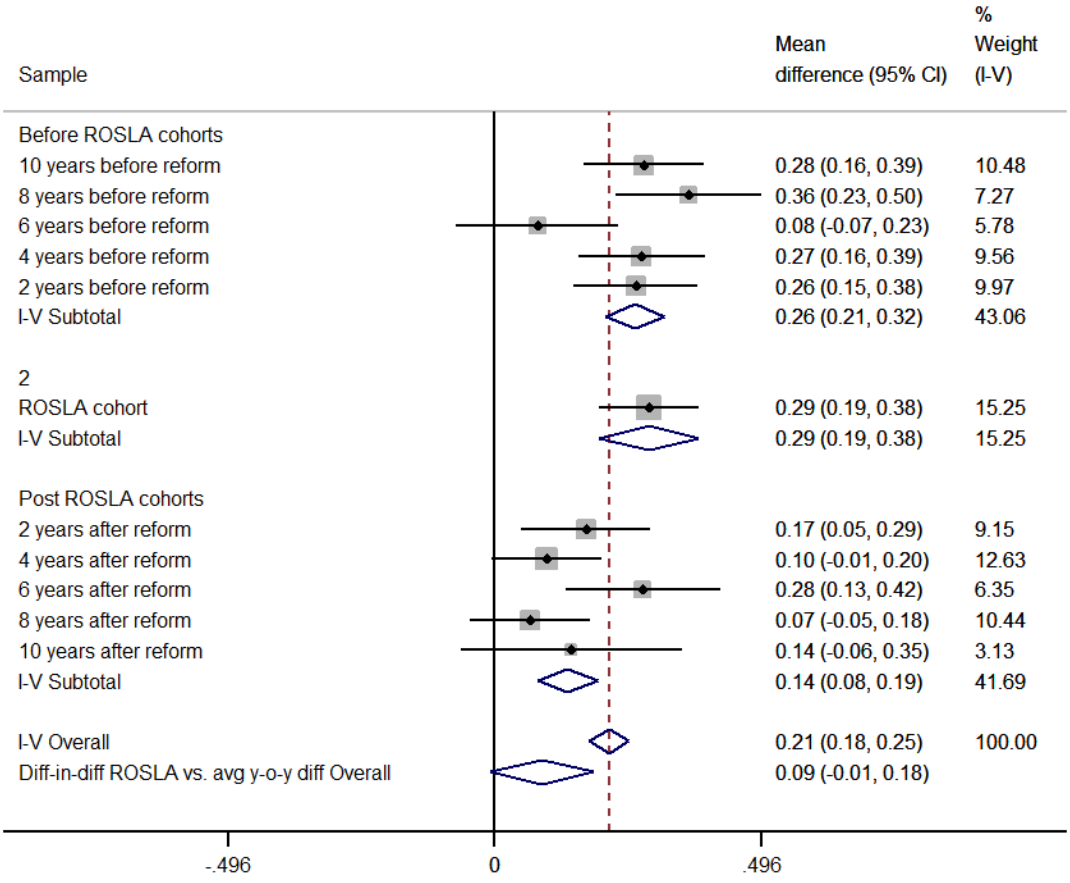
Supplementary Figure 18: The effect of the reform on grip strength, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform had higher grip strength than those born the year before. This difference was larger than the average year-on-year differences before and after the reform. However, it was similar to the year-on-year difference in two years before the reform.



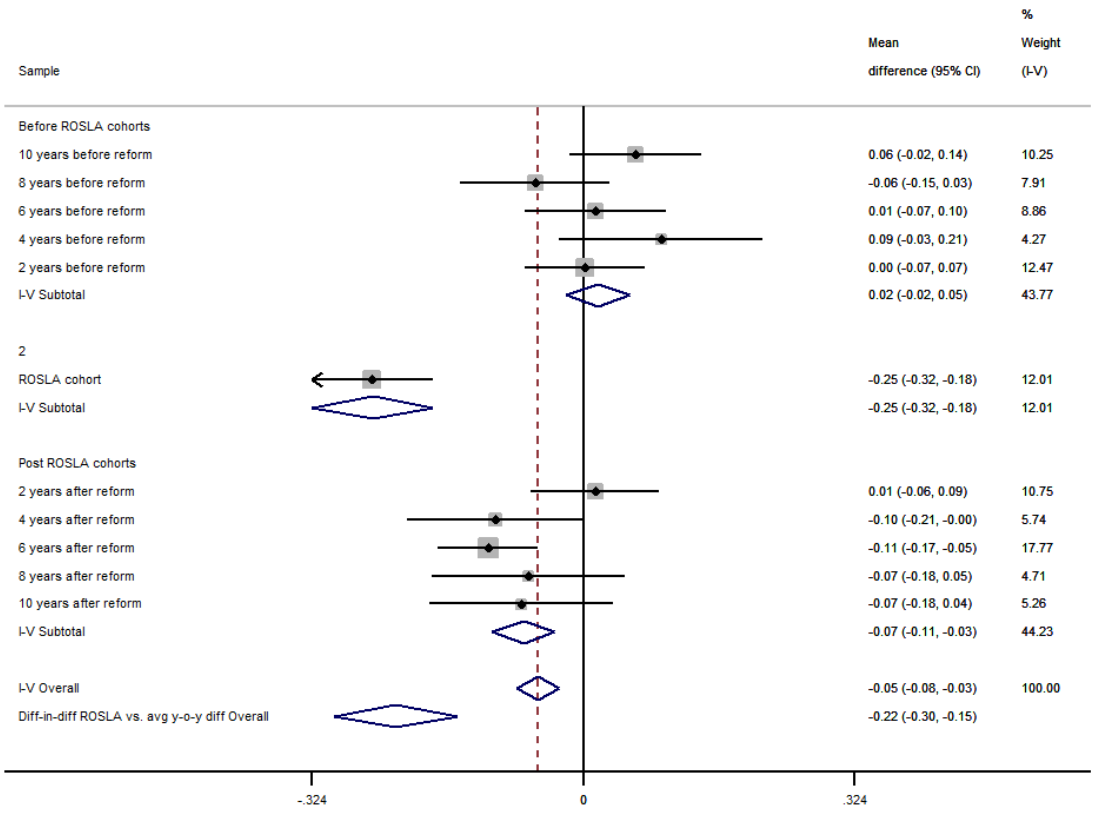
Supplementary Figure 19: The effect of the reform on arterial stiffness, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform had lower arterial stiffness than those born the year before. This difference was similar to the average year-on-year differences before and after the reform.



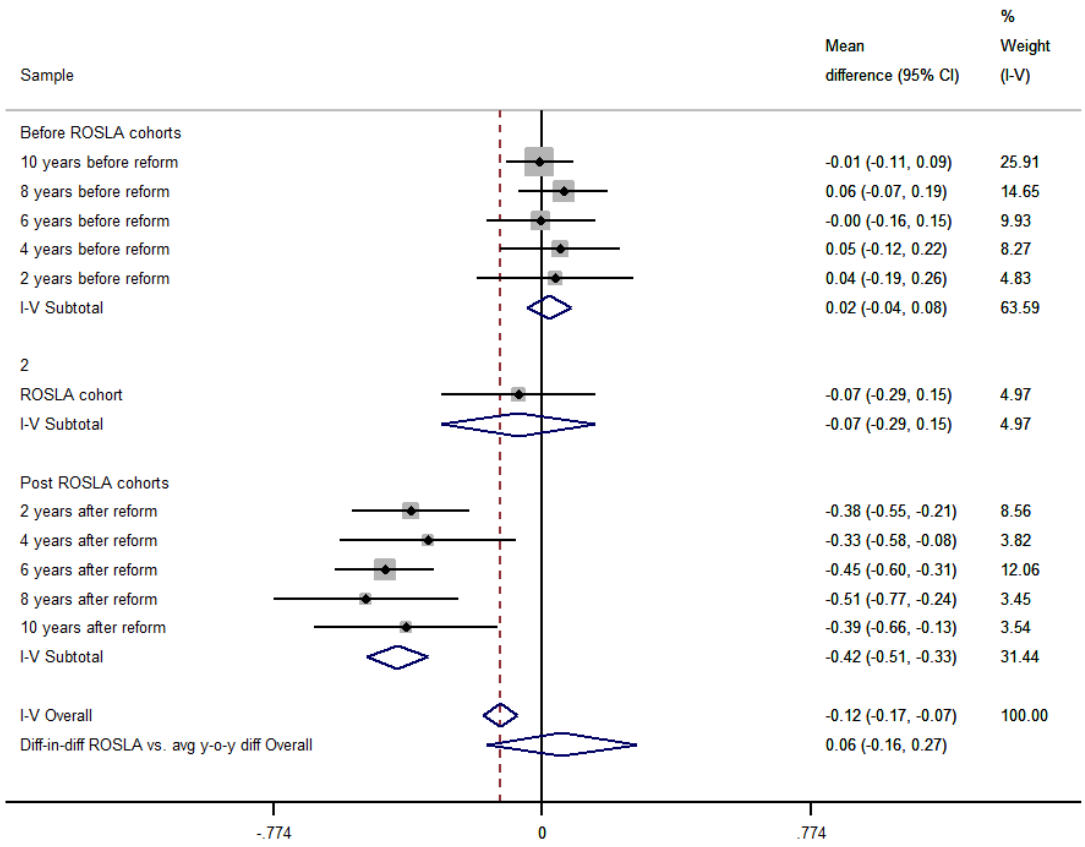
Supplementary Figure 20: The effect of the reform on height, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform were taller than those born the year before. This difference was similar to the average year-on-year differences before and after the reform.



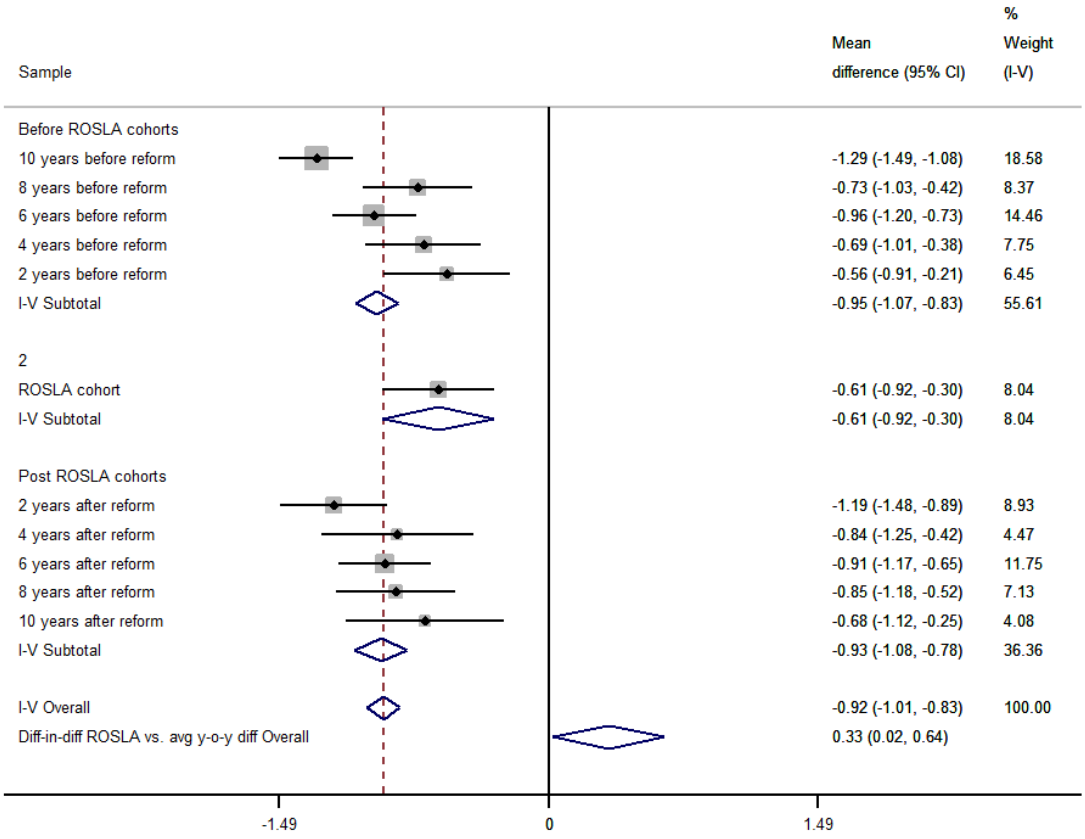
Supplementary Figure 21: The effect of the reform on BMI, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform had lower BMI than those born the year before. This difference was larger than the average year-on-year differences before and after the reform.



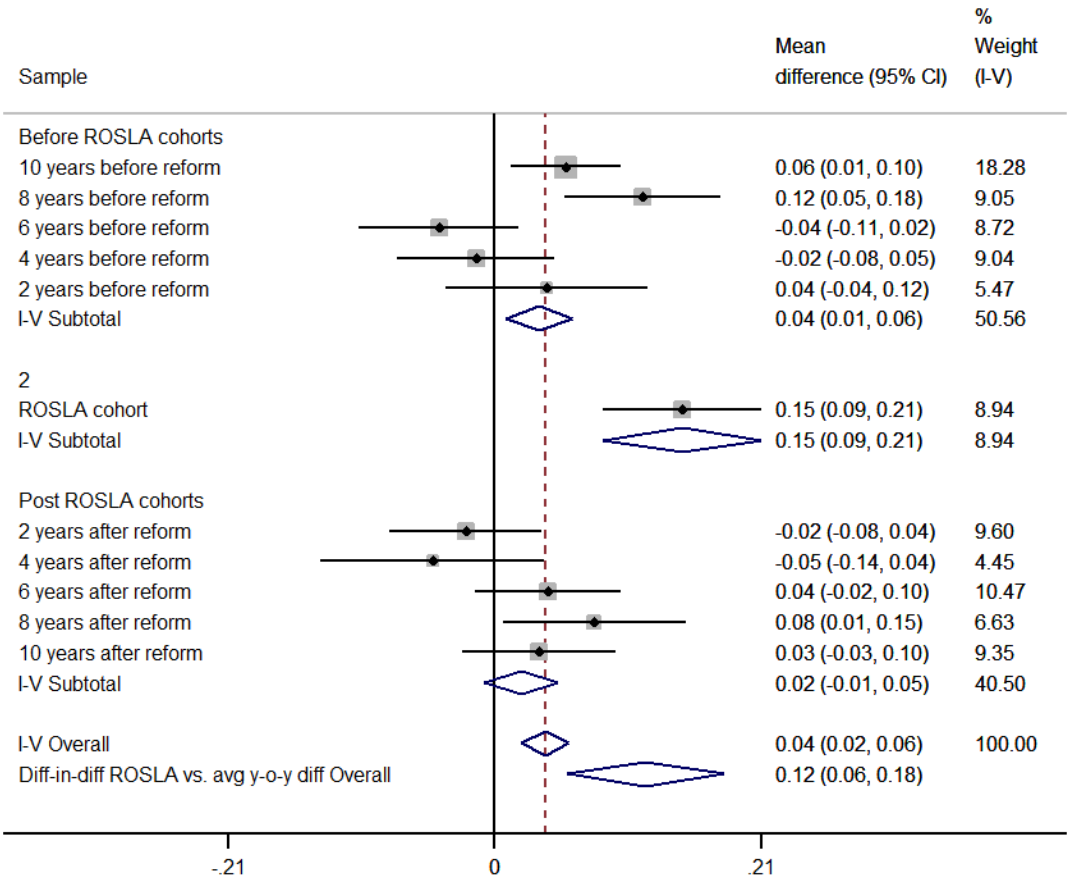
Supplementary Figure 22: The effect of the reform on diastolic blood pressure, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform had similar diastolic blood pressure than those born the year before. This difference was similar to the average year-on-year differences before the reform, and smaller than the average year-on-year difference after the reform.



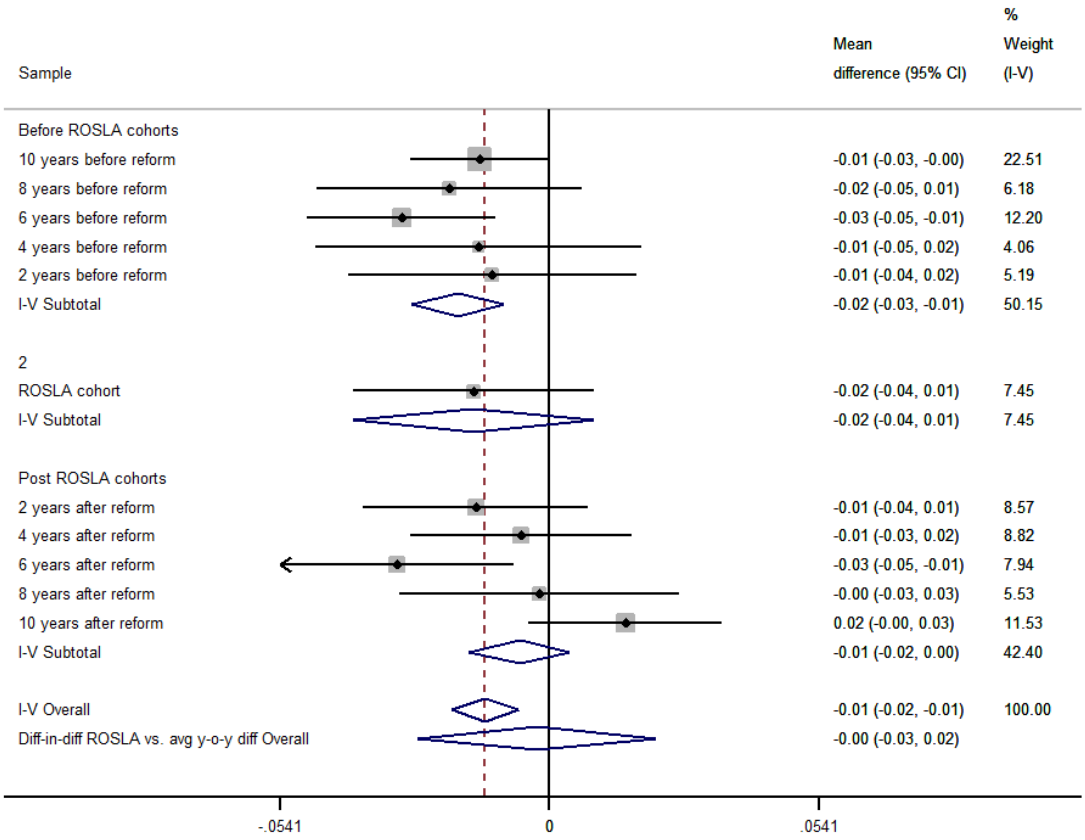
Supplementary Figure 23: The effect of the reform on systolic blood pressure, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform had lower systolic blood pressure than those born the year before. However, this difference was similar to the average year-on-year differences before and after the reform.



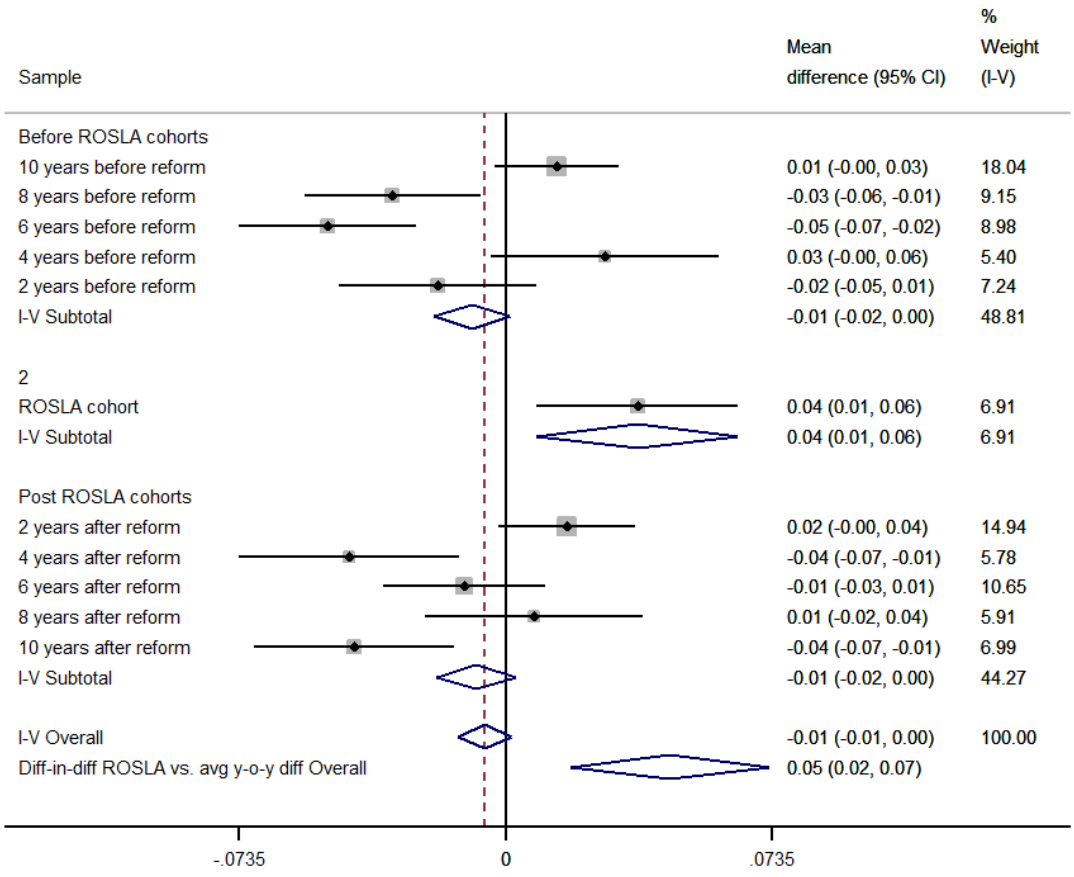
Supplementary Figure 24: The effect of the reform on intelligence, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform had higher scores on the intelligence tests than those born the year before. This difference was larger than the average year-on-year differences before and after the reform. However, this difference was similar to the year-on-year difference in eight years before the reform.



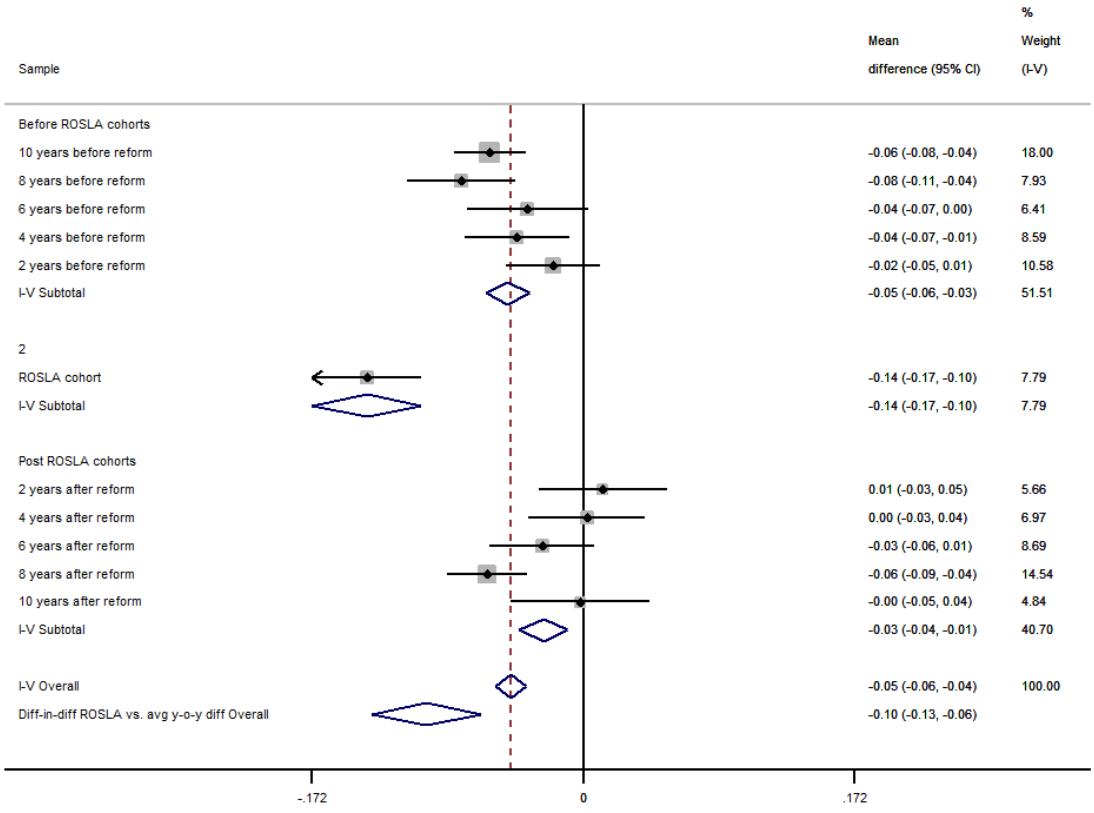
Supplementary Figure 25: The effect of the reform on subjective well-being, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform reported similar subjective well-being as those born the year before. This difference was similar to the average year-on-year differences before and after the reform.



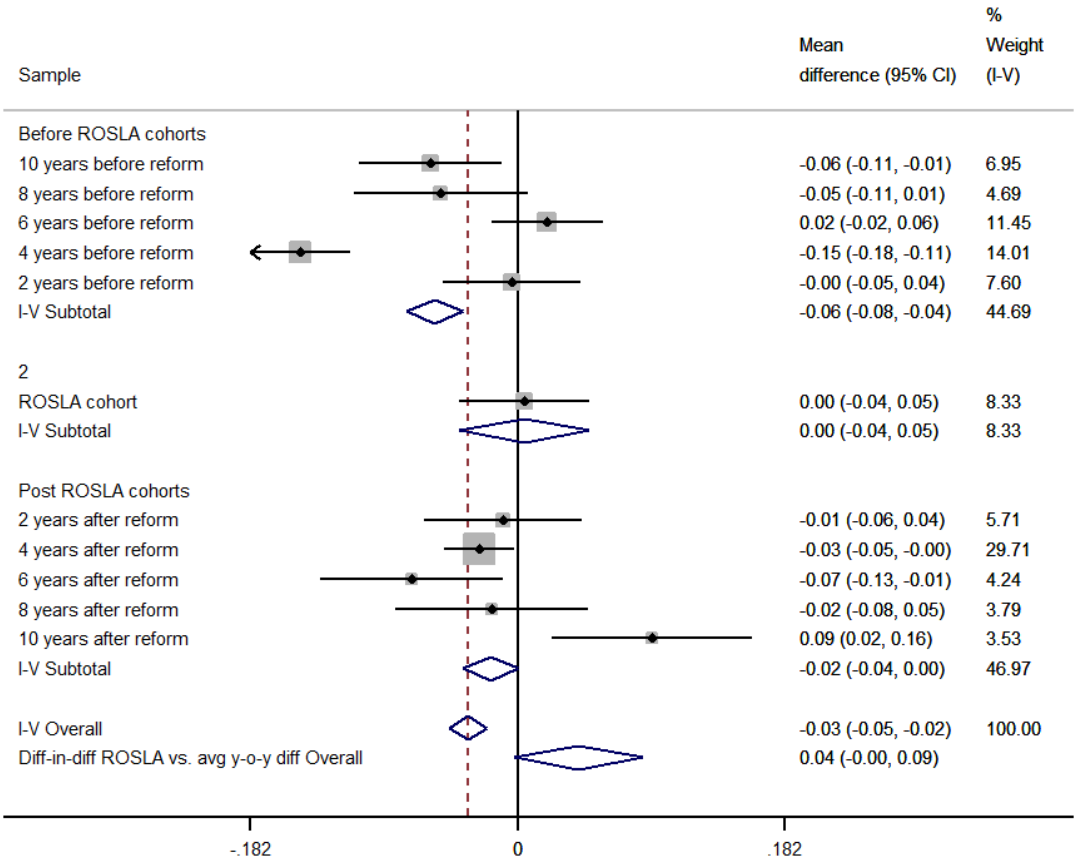
Supplementary Figure 26: The effect of the reform on alcohol consumption, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform reported higher alcohol consumption than those born the year before. This difference was larger than the average year-on-year differences before and after the reform. However, this difference was similar to the year-on-year difference in four years before and two years after the reform.



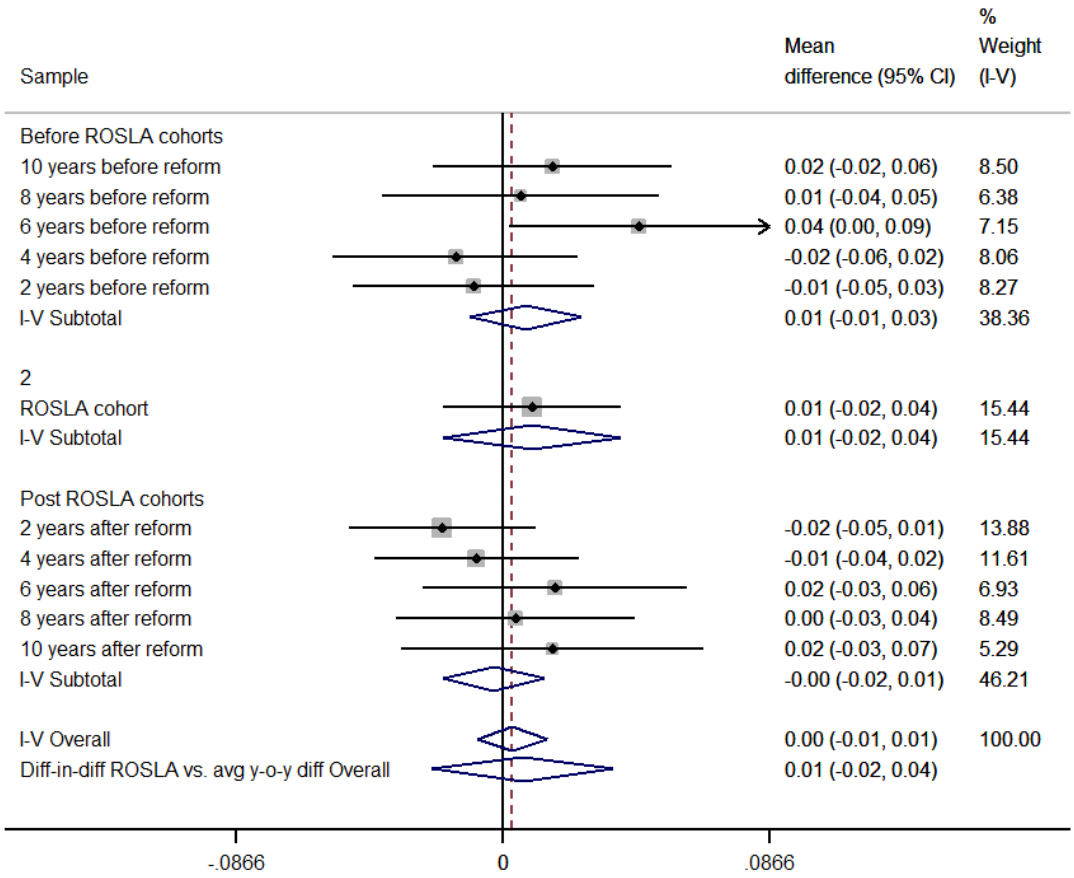
Supplementary Figure 27: The effect of the reform on sedentary behaviour, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform spent less time engaging in sedentary behaviour than those born the year before. This difference was larger than the average year-on-year differences before and after the reform.



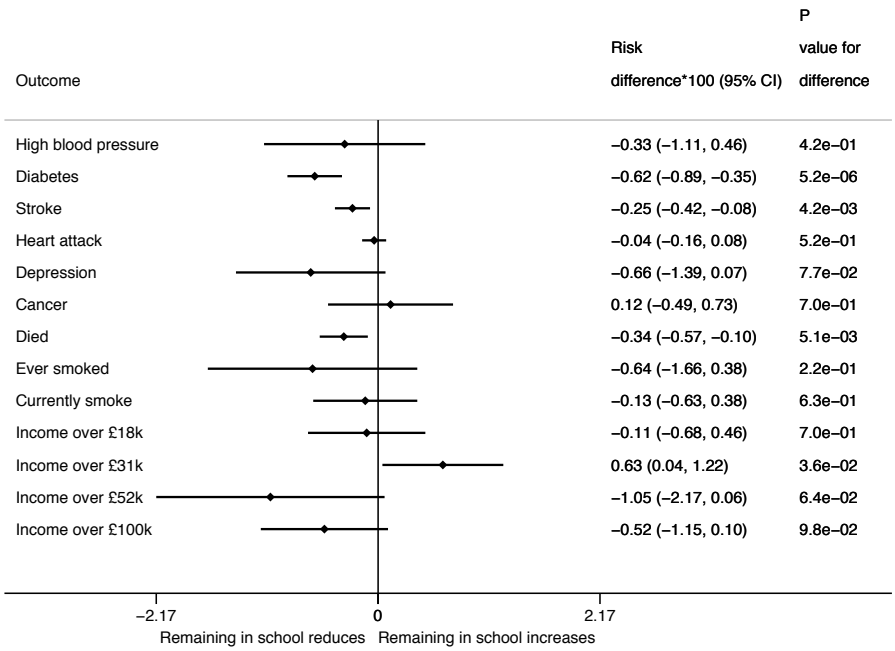
Supplementary Figure 28: The effect of the reform on frequency of engaging in moderate physical activity, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform reported similar frequency of moderate physical activity as those born the year before. This difference was similar to the average year-on-year differences before and after the reform.



Supplementary Figure 29: The effect of the reform on frequency of engaging in vigorous physical activity, compared to negative control "dummy reforms" in the ten years either side of the reform. Participants in the first year affected by the reform reported similar frequency of vigorous physical activity as those born the year before. This difference was similar to the average year-on-year differences before and after the reform.

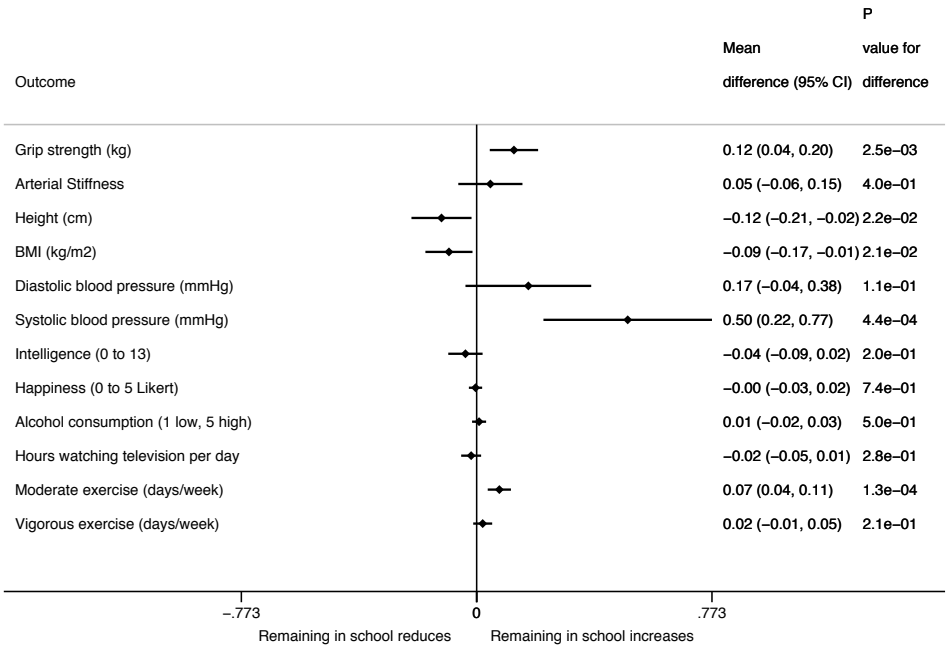


Supplementary Figure 30: Effect of the reform on binary outcomes, difference-in-difference estimate accounting for age effects. Unweighted.



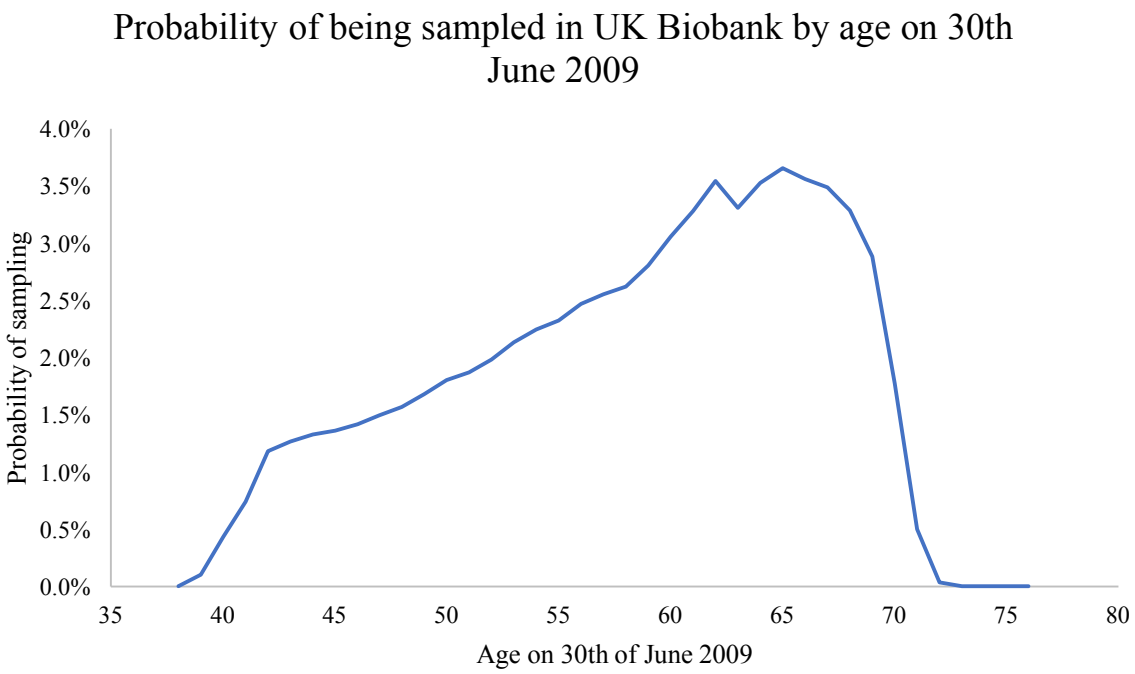
Notes: Difference in difference estimate of the effect of the raising of the school leaving age on binary outcomes. All estimates control for gender and month of birth. Estimates are the difference between the year-on-year difference in outcome across the raising of the school leaving age compared to the average year on year difference. Estimated using robust linear regression, with standard errors clustered by month of birth and without weighting. Differences and confidence intervals calculated using Bland-Altman tests.(60) The estimates for diabetes, stroke, mortality exceed Benjamini and Hochberg (1995) threshold for multiple hypothesis testing.

Supplementary Figure 31: Effect of the reform on continuous outcomes, difference-in-difference estimate accounting for age effects. Unweighted.



Notes: Difference in difference estimate of the effect of the raising of the school leaving age on continuous outcomes. All estimates control for gender and month of birth. Estimates are the difference between the year-on-year difference in outcome across the raising of the school leaving age compared to the average year on year difference. Estimated using robust linear regression, with standard errors clustered by month of birth and without weighting. Differences and confidence intervals calculated using Bland-Altman tests.(60) The estimates for grip strength, systolic blood pressure, and moderate physical activity exceed the Benjamini and Hochberg (1995) threshold for multiple hypothesis testing.

Supplementary Figure 32: The probability of being sampled in UK Biobank by age on 30th June 2009.



Notes: Denominators taken from Office of National Statistics mid-year population estimates for England, Wales and Scotland in 2009. If the reform had a large effect on participation, then we would expect people aged 51 (who were affected by the reform) to be more likely to participate than those aged 52 (who were not). Unweighted data.